

# SERDP

Strategic Environmental Research  
and Development Program

Improving Mission Readiness Through  
Environmental Research

## SERDP Scientific Advisory Board ANNUAL REPORT TO CONGRESS

### FISCAL YEAR 1998



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**ANNUAL REPORT TO CONGRESS—  
FISCAL YEAR 1998**

**FROM THE**

**SCIENTIFIC ADVISORY BOARD**

**OF THE STRATEGIC ENVIRONMENTAL RESEARCH  
AND DEVELOPMENT PROGRAM**

**March 1999**

# FOREWORD

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During FY98, the SAB continued and expanded its activities and involvement with SERDP. The Board reviewed 24 continuing projects, valued at \$25.26 million, and 30 FY98 and FY99 new start proposals, valued at \$15.86 million.

The SAB was important in refining SERDP's strategic vision and in focusing on these goals at the meetings throughout the year. There was agreement that SERDP must address not only defense readiness-related environmental concerns, but also environmental issues concerning long-range national security policy formulation, decision making, and management.

The workshop on the needs and opportunities for Environmentally Acceptable Endpoints (EAE) for metals, solvents, and energetics conducted by SERDP this past summer was a tremendous success, thanks in part to the involvement of select members of the SAB. This workshop provided a scientific foundation upon which to support research on detailed, specific requirements. A focused Statement of Need requesting proposals in the area of EAE has been issued in FY 1999 for a possible FY 2000 new start. An additional workshop has been proposed to focus research efforts on opportunities in the compliance area. Members of the Compliance subcommittee, in cooperation with the American Academy of Environmental Engineers and SERDP staff, are actively involved in the planning and execution of a workshop focused on Air Emissions Compliance planned for early summer.

The Board is encouraged by SERDP's efforts in FY 1998 to enhance technical quality, focus on strategic environmental issues, and distribute scarce resources. The Board believes that SERDP is a good public investment. Furthermore, the Board and I want to thank you for your support of SERDP.



C. Herb Ward  
Chair, FY 1998  
SERDP Scientific Advisory Board

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# EXECUTIVE SUMMARY

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Section 2904(h) of title 10, United States Code, requires the Strategic Environmental Research and Development Program (SERDP) Scientific Advisory Board (SAB) to submit an annual report to Congress no later than March 15 of each year. The Annual Report is required to describe the actions of the SAB during the preceding year and to provide any recommendations, including recommendations related to projects, programs, information exchange, and additional legislation within the scope of SERDP. This is the seventh Annual Report of the SERDP SAB and includes SAB activities and Program recommendations during FY98.

During FY 1998, the Board continued to emphasize the strategic role of SERDP and the essential function of the SAB to guide SERDP activities toward building a scientifically sound and strategically focused program. The Board recognizes the unique position of SERDP as the "strategic" defense environmental research and development (R&D) program. To this end, a SERDP project should focus on research that is

- essential for the solution of a major defense mission-readiness related problem;
- scientifically plausible;
- targeted to areas where progress under other program sponsorship in the Department of Defense (DoD) and/or other agencies is not sufficient or satisfactory;
- catalytic in nature to initiate, organize, and accelerate essential research in partnership with the Federal and private sector; and
- capable of providing sufficient proof-of-principle demonstrations to attract follow-on Research, Development, Test & Engineering (RDT&E) support.

As a group, the SAB reviewed and provided funding recommendations for 54 projects with a total value in excess of \$41 million. As the SERDP program has matured, the Board has been paying increasing attention to the connectivity between projects and how technologies that are being developed with SERDP funding will be implemented within the broader context of DoD systems and their life cycle. The interest of the Board in emphasizing the SAB's role on the macro rather than micro level is reflected in the desire that similar SERDP projects be briefed together and that briefings on SERDP projects be supplemented with informational briefings on related non-SERDP efforts.

The Board is pleased with and endorses a strong technical review of all proposals and projects by the Technology Thrust Area Working Groups (TTAWG) and the continuation of the independent peer review of all SERDP proposals, which was initiated in FY97. The SAB also encourages the use of Technical Advisory Committees (TAC) to provide technical oversight for major projects or efforts that address the same subject area. Examples include the TAC for the Federal Integrated Biotreatment Research Consortium (FIBRC) and the SERDP Ecosystem Management Program (SEMP), which is itself a direct result of an initiative by members of the Board to identify research needs and opportunities in the area of ecosystem management.

The Board supported the efforts by the Executive Director and Council to increase direct participation by the non-Federal sector. Additionally, the Board strongly favored leveraged funding of projects, regardless of the performer. Members strongly encouraged the eventual users of technologies, specifically the three Services, to provide support and, given successful development, reasonable assurances of cooperative funding in the project's later years.

The Executive Director continued to involve fully the SAB members in most all management issues. The Board's influence on the Program extended beyond the routine process of approving projects that exceed a funding threshold. The Executive Director encouraged the SAB to continue to participate in the following activities:

- provide recommendations in the project selection process;
- identify opportunities for technology development;
- foster technology transfer between the private sector and governmental agencies;
- determine feasibility and applicability of using Federal monitoring systems and data resources for environmental purposes, especially in the conservation of land resources arena; and
- participate in overall strategy formulation and program management issues.

Specific examples included the involvement and direction provided by four members of the Board in a workshop on Environmentally Acceptable Endpoints for metals, solvents, and energetics in soil, which was held in June of 1998 and has resulted in the initiation of new research efforts starting in FY 2000, as well as the publication of a scientific text on the state of scientific knowledge in this important area. Efforts are already under way for a similar technical workshop on Air Emissions to be held in early summer 1999.

Representing a diverse membership from a host of professional backgrounds and areas of recognized expertise from this nation's scientific community, the SERDP Scientific Advisory Board provides a balanced and forward-looking perspective in all phases of its work. The Executive Director continues to foster a resultant synergism that is created by the gathering of this diverse expertise. The role of the SAB is strengthened further by the annual appointment of new members who rejuvenate the Board and add important new areas of scientific expertise.

Looking ahead to the future, the SAB will continue to take advantage of the expertise and knowledge of its members to strengthen the strategic role of SERDP and identify emerging environmental areas of opportunity that can benefit SERDP, defense program managers, and the environmental community at large.

# ORGANIZATION

## THE SERDP MANAGEMENT STRUCTURE

SERDP is a multi-agency (Department of Defense, Department of Energy, Environmental Protection Agency) managed program funded by the Department of Defense. Pursuant to title 10, U.S.C., SERDP receives general oversight and policy guidance from the SERDP Council composed of members from the DoD, DOE, and EPA. The SERDP Scientific Advisory Board (SAB) is charged with providing advice and recommendations to the SERDP Council on projects/proposals reviewed and may advise the Council regarding other programmatic, funding, or technically related issues with respect to the Program.

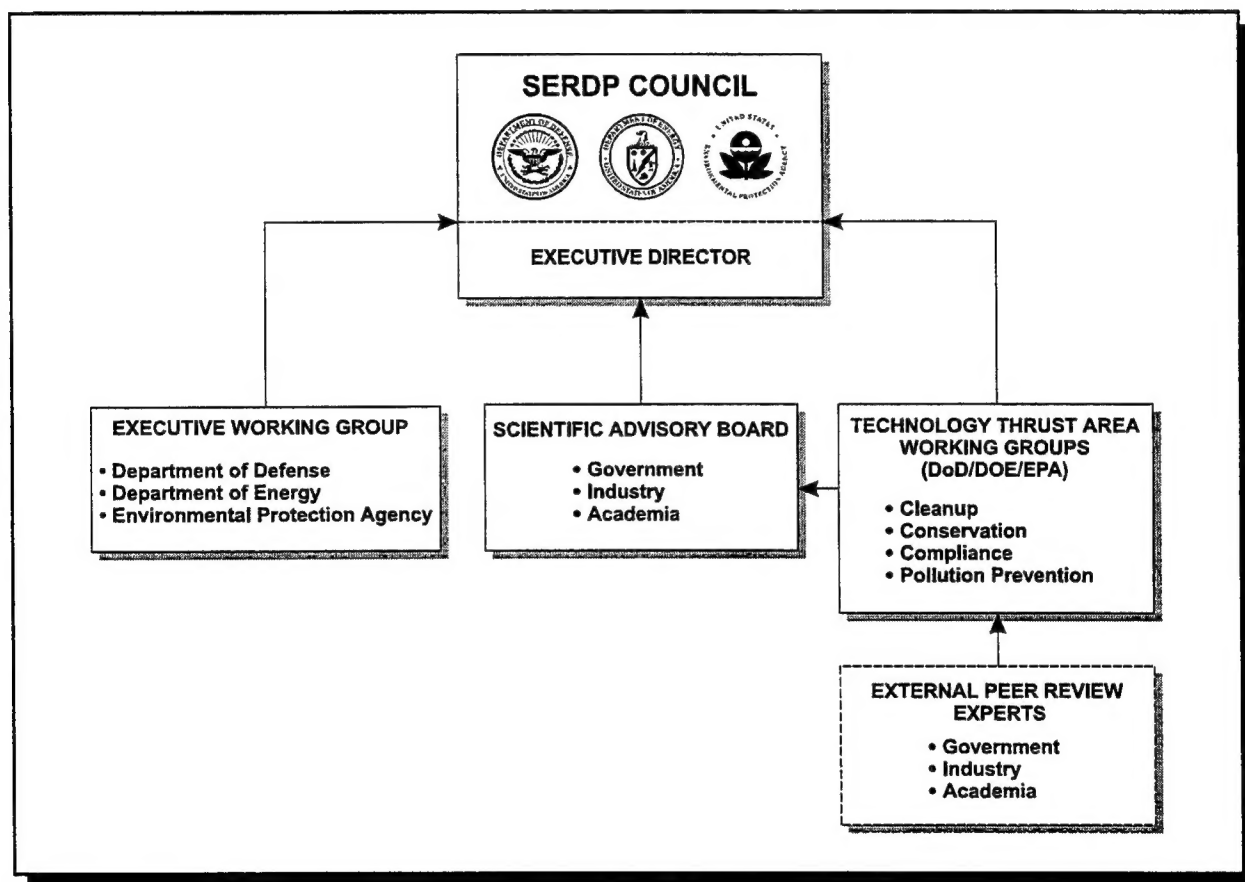


Figure 1 SERDP Organization

During FY 1998, Mr. Bradley P. Smith, the Executive Director of SERDP, continued to serve as the Designated Federal Officer attending the SERDP SAB meetings in accordance with the requirements of Subsection 10(e) and (f) of the Federal Advisory Committee Act. Mr. Smith called each of the meetings in the Federal Register, approved the agendas, and attended five of the six scheduled meetings of the

SERDP SAB. SERDP Technical Director, Dr. Jeffrey Marqusee, served as the Designated Federal Officer for the June 1998 meeting.

## THE SERDP THRUST AREAS

SERDP's Thrust Areas (Cleanup, Compliance, Conservation, and Pollution Prevention) correspond with the four Pillars that exist within the Office of the Deputy Under Secretary of Defense for Environmental Security. SERDP seeks to identify and promote technologies that (1) improve cleanup effectiveness and reduce resultant costs to the Department of Defense and Department of Energy; (2) reduce the number of Notices of Violation (NOV) and mitigate the cost impact of the NOVs; (3) improve DoD's capability to maintain force readiness through enhancement of testing and training lands and serve as proper stewards of Federal lands; and, (4) eliminate the occurrence of future hazardous and toxic impacts by materials substitution and process modifications.

### *Cleanup*

The principal focus of this area is to develop more cost effective methods and technologies for remediation, monitoring, characterization, and assessment. Research in this Thrust Area seeks to achieve more efficient, effective environmental cleanup of soil, sediment, groundwater, surface water, and structures already contaminated by past practices with hazardous materials, such as unexploded ordnance and toxic substances.

### *Compliance*

Compliance research and development includes technologies supporting both environmental monitoring and waste treatment/disposal, as well as environmental management related to meeting current and future environmental compliance requirements. Other issues addressed include understanding the fate and transport of defense-related air and waste water discharges and end-of-pipe recycling, i.e., waste that is recycled for other than its original purpose.

### *Conservation*

There is a growing need to use and maintain training and testing facilities effectively to support environmental and operational requirements. Management of natural resources is an important consideration in maintaining the use of these facilities to provide the realistic training environment in which to exercise and test the capabilities of the military forces. Therefore, efforts in this Thrust Area focused on research to understand, protect, and maintain natural resources in order to ensure

- compliance with environmental laws [such as the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), and the National Historic Preservation Act (NHPA)]
- sustainable use of land and coastal resources
- support for the stewardship of those resources on relevant Federal lands

Research efforts were intended to predict effectively the presence, quantity, and quality of natural and cultural resources; improve the knowledge of the basic natural land and coastal processes as they relate



to, and are impacted by, use of lands; and advance the technology to mitigate, rehabilitate, and maintain these resources.

### ***Pollution Prevention***

The goal of this Thrust Area is to reduce or eliminate the creation of pollutants thereby decreasing the need for their treatment and disposal and reducing the cost of compliance with future environmental regulations. During FY 1998, research focused on

- identifying alternatives for or minimizing the use of hazardous and toxic chemicals/materials
- identifying alternative processes or technologies that result in fewer pollutants
- improving the efficiencies of mechanical and chemical systems
- assessing the life-cycle effect of materials and systems

The application of pollution prevention will influence the other SERDP Thrust Areas positively by encouraging the use of innovative, pollution-reducing technologies and practices.

## **FY 1998 SAB MEMBERSHIP**

Section 2904(a-c) of title 10, U.S.C. requires the joint appointment of members of the Scientific Advisory Board by the Secretary of Defense and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency. Members were solicited and nominated in accordance with the statute from the three participating agencies, the National Academy of Sciences, the Council on Environmental Quality, and the National Association of Governors. With regard to the SAB Membership, the statute requires that

- one member shall be the Science Advisor to the President, or his/her designee;
- one member shall be the Administrator of the National Oceanic and Atmospheric Administration (NOAA), or his/her designee;
- at least one member shall be a representative of environmental public interest groups; and

### **SAB Members and Affiliations**

Dr. Michael J. Ryan, Chair	— Bechtel Jacobs Company LLC
Dr. Jean'ne M. Shreeve, Vice Chair	— University of Idaho
Dr. Patrick R. Atkins	— Aluminum Company of America
Dr. Rosina M. Bierbaum	— Office of Science and Technology Policy
Mr. Richard A. Carpenter	— Environmental Consultant
Mr. Richard A. Conway	— Environmental Consultant
Mr. Amos S. Eno	— National Fish and Wildlife Foundation
Dr. Raymond C. Loeher	— University of Texas
Dr. Perry L. McCarty	— Stanford University
Dr. Roger O. McClellan	— Chemical Industry Institute of Toxicology
Dr. Lydia W. Thomas	— Mitretek Systems, Inc.
Dr. C. Herb Ward	— Rice University
Mr. Robert S. Winokur	— National Oceanic and Atmospheric Administration
Mr. Randolph Wood	— Nebraska Department of Environmental Quality

**Exhibit 1 - Membership of the SERDP Scientific Advisory Board During FY 1998**

- at least one member shall be a representative of the interests of State governments.

Exhibit 1 lists the members of the Board during FY 1998. Appendix A contains short biographies of each SAB member.

The year began with 14 members on the Board; however, Mr. Amos Eno, Mr. Richard Carpenter, and Dr. Lydia Thomas resigned leaving 11 members at the year's end. Dr. Michael Ryan and Dr. Jean'ne Shreeve served as SAB Chair and Vice Chair, respectively, for FY 1998. Dr. Herb Ward was nominated and elected as Chair for FY 1999 and Dr. Shreeve was reelected to serve a second term as Vice Chair. During this fiscal year, Dr. Rosina Bierbaum continued to serve as the designee for the Science Advisor to the President. Mr. Robert Winokur continued to serve as the statutory member representing the Administrator of the National Oceanic and Atmospheric Administration. Mr. Eno and Mr. Carpenter represented environmental public interest groups while Mr. Randolph Wood represented the interests of State governments. New appointees included Dr. Patrick Atkins, Dr. Perry McCarty, Dr. Roger McClellan, and Dr. Herb Ward.

The members effectively used a subcommittee structure in order to utilize members' expertise and time more efficiently in the review of more than 50 projects that were brought before the SAB during FY 1998. This also allowed a more effective means to handle more detailed information on specific projects and to provide follow-on review of issues and questions raised during the project review process. Exhibit 2 lists the subcommittee membership.

<b>CLEANUP:</b>	<b>COMPLIANCE:</b>	<b>CONSERVATION:</b>	<b>POLLUTION PREVENTION:</b>
Richard Conway	Rosina Bierbaum	Rosina Bierbaum	Patrick Atkins
Raymond Loehr	Richard Carpenter	Richard Conway	Richard Carpenter
Perry McCarty	Amos Eno	Amos Eno	Perry McCarty
Roger McClellan	Herb Ward	Raymond Loehr	Roger McClellan
Michael Ryan	Robert Winokur	Robert Winokur	Michael Ryan
Jean'ne Shreeve	Randolph Wood	Randolph Wood	Jean'ne Shreeve
Lydia Thomas			Lydia Thomas
Herb Ward			

**Exhibit 2 - SAB Subcommittees**

# ACTIVITIES AND RECOMMENDATIONS

## ACTIVITIES

### Meetings

In accordance with Section 2904, title 10, U.S.C., the Scientific Advisory Board is required to meet a minimum of four times during the fiscal year. In fiscal year 1998, the SAB met on six occasions. The first five of these meetings were held in Arlington, VA. The final meeting of the year was held at the U.S. Army Corps of Engineers Waterways Experiment Station (WES) in Vicksburg, MS, as a result of the Board's significant interest to attend a meeting at a Federal research location. Dr. Robert Whalin, Director of WES; Colonel Robert Cababa, Commander of WES; and Dr. John Harrison, Director of the WES Environmental Laboratory hosted the SAB for a three-day session. At this meeting, the SAB not only conducted a full schedule of project briefings but also received a tour of WES facilities and related ongoing environmental research efforts.

During Fiscal year 1998, the SAB reviewed all research proposed with funding requests in excess of \$900,000 as well as all New Start proposals selected for funding. Consistent with the statute, the Board also made recommendations to the SERDP Council through the Executive Director regarding the projects reviewed. They also assisted and advised the Council in identifying environmental opportunities and provided advice on other environmental issues within the scope of SERDP.

Table 1 provides a list of dates and locations of all SAB meetings held during FY 1998. In accordance with the Federal Advisory Committee Act, all meetings were open to the public and detailed records of events were maintained. Further, all records, reports, working papers, and agendas were made available to the public for review. In FY 1998, no requests were made to review this information.

SAB Meeting No.	Dates	Location	Projects Briefed		
			Ongoing	New Starts	Total
1	October 30, 1997	Federal Highway Administration Conference Room Arlington, VA	0	5	5
2	January 28-29, 1998	Federal Highway Administration Conference Room Arlington, VA	2	1	3
3	March 31-April 1, 1998	Holiday Inn at Ballston Arlington, VA	9	0	9
4	June 17-18, 1998	Holiday Inn at Ballston Arlington, VA	9	1	10
5	August 12-13, 1998	Arlington Hilton Arlington, VA	1	11	12
6	September 23-25, 1998	U.S. Army Engineers Waterways Experiment Station Vicksburg, MS	3	12	15

Table 1 - Summary of FY98 SAB Meetings

### ***Commitment to Focus on the "Strategic" Nature of SERDP***

Consistent with the position it took in FY 1997, the SAB reaffirms its commitment to ensure that SERDP focuses on issues of a strategic nature. The Board collectively agreed that a periodic review of the term "strategic" would be of value to ensure that recommended projects are meeting desired objectives from a programmatic viewpoint. The SAB further agreed to adopt the definition of the term "strategic" as illustrated in the FY 1997 SAB Annual Report to Congress. It is restated here.

"SERDP should be proactive and visionary as opposed to reactive and, as such, should focus on undertaking high-risk, potentially high-payoff research and development projects. Such projects are commonly long term in nature and, in all cases, projects that are best carried out by partnerships among the Services, other participating Federal agencies, academia, and the private sector. SERDP must address not only defense industrial complex and DoD force readiness-related environmental concerns and issues, but also strategic environmental issues of concern to long-range national security policy formulation, decision making, and management. Environmental degradation directly impacts both human and ecological health and well-being, as well as indigenous natural resources and economic viability. Environmental integrity is thus recognized clearly as key to the economic and social welfare of nations."

The Board agreed that part of its mission as stated in the statute was to provide SERDP with strategic, directional guidance and ensure that projects have embodied a sound technological and programmatic approach. To further their opportunity to provide this strategic guidance, the SAB members voiced the utility and benefit of having out-of-program information briefings that would enlighten the members as to DoD needs, program initiatives, and other upcoming DoD issues, such as use of composite materials and the concept of zero discharge ships. During the course of the year, the Board heard several such briefings, including those that addressed the Land Management System, the Environmentally-Sound Ships Program, and the Joint Group on Acquisition Pollution Prevention as well as an overview of Unexploded Ordnance (UXO) issues.

The Board concluded that the most effective means to influence the strategic nature of SERDP was to become immersed in developing the Statements of Need for future research efforts. How better to effect the strategic approach to program development than to review the needs for research to which proposers must respond? The Executive Director provided the entire Board membership a chance to review these Statements of Need prior to their inclusion in SERDP's Broad Agency Announcement and the Federal Call For Proposals. This review resulted in no changes or adjustments to the Needs documents.

### ***Commitment to Ensuring Quality Research***

Coupled with its emphasis on strategic research, the Board also expended considerable energy on how it could assist SERDP in one of the Program's Keys to Success: Ensuring World Class Research. The SAB addressed this issue from several avenues.

- First, the members strongly endorsed the established solicitation and review process. The SAB firmly believes that SERDP should embrace the widest competition possible through direct participation of non-Federal research capabilities. As illustrated by the FY 1998 competition, the

Federal, academic, and private industrial sectors each contributed well to the overall Program content. The peer review process was cited by the SAB as one that should be emulated by others.

- Second, the members encouraged use of a Technical Advisory Committee (TAC) for all "umbrella"-type projects, i.e., those that were a conglomeration of subprojects and centrally managed by a laboratory or agency representative. Candidate projects in this category include the Federal Integrated Biotreatment Research Consortium, the Next Generation Fire Suppression Technology Program, and the SERDP Ecosystems Management Project. While each of these projects is uniquely managed, they all have one common element - a TAC. In addition, the Board encourages using the TAC to review and assess the attributes of other related SERDP projects.
- Third, the Board fully supported the mid-year In Progress Review of each project by the Technical Thrust Area Working Groups and their assessment of Go/No-Go decision points recently induced into project plans. While the SAB's primary function is to assess the technical aspects of SERDP projects, the Board has insufficient time to conduct a thorough technical evaluation of each ongoing project. The TTAWG is the appropriate group to perform this assessment. With the introduction of Go/No-Go decision points, the value of this review has increased significantly.

In a related matter, the SAB acknowledges that specific projects are funded at the recommendation of Congress. The SAB appreciates the opportunity to assess these projects; however, the Board is concerned that its review of these projects constitutes a tacit endorsement. One of two projects requested by Congress was not recommended for funding because of its lack of relevance and technical merit.

### ***Commitment to Technology Transfer***

The membership of the SAB agreed with the opinions of the SERDP Staff and Technology Thrust Area Working Groups that technical merit and personnel, while important criteria for proposal evaluation, are insufficient. One must consider technology transfer as well. Technology transfer is one of the SERDP Keys to Success and the Board members continued their keen interest in the role of the military Services and eventual users of the technologies being developed.

During their review of proposals as well as ongoing projects, the SAB members probed each Principal Investigator as to what contributions the military Service of interest was making. As each project matured in its SERDP lifetime, the SAB expected an increased amount of leveraged funding in the support of the effort. This contribution represented a clear linkage to the eventual users of the technology.

In FY 1998, the SAB concentrated on two primary aspects of technology transfer

- 1) Service participation in each SERDP effort from start to project conclusion
- 2) Accountability of each project with regard to submission of technical reports

Technical reporting, including SERDP-required interim and final technical reports, as well as peer reviewed publications was a metric used to determine project technical progress and management acumen. The SAB enthusiastically supported SERDP management's decision to require annual/interim technical reports and a final technical report upon completion of the project. These reports constitute technical progress to date, whether successful or not, on each project's technical approach. The value of "negative results" cannot be overstated. SERDP projects should clearly state their progress and publish these results to facilitate further research.

As further evidence of their commitment to technology transfer, select Board members elected to participate in SERDP's annual Technical Symposium and Workshop. At the December 1997 event, Dr. Michael Ryan served as a "keynote" speaker during the symposium plenary session, and Dr. C. Herb Ward served as chair for a technical session on In-Situ Bioremediation. Their commitment to a successful technology transfer event only increased in the latest Symposium held in December 1998, with four members chairing technical sessions and Dr. Rosina Bierbaum providing a plenary address.

## RECOMMENDATIONS

### *Areas of Opportunity*

Two significant events resulted from the Board's attention to DoD operations, issues, and a review of the current needs-- a workshop conducted in June of 1998 on Environmentally Acceptable Endpoints (EAE) for chlorinated solvents and metals in soil and groundwater and a workshop planned for FY 1999 focusing on Air Emissions. The American Academy of Environmental Engineers (AAEE), in cooperation with select members of the SAB, planned and conducted the workshop on EAE. While the AAEE is publishing proceedings and results of the workshop, the primary objective from SERDP's interest was to identify any gaps in research and those opportunities that are worthy of SERDP/DoD investment. As a result of the workshop deliberations, a clear, focused statement of need was developed to establish better bioavailability and long-term stability issues associated with metals in soils.

AAEE also is planning the Air Emissions workshop that will define the research needed to characterize, assess impacts of, and minimize the air pollutant emissions from military diesels, turbine engines, and ordnance systems. The workshop will emphasize air pollutant formation processes, monitoring, control, and impacts resulting from public/ecological exposure. Similar to previous SERDP workshops, it will assess the state of the science, identify gaps in technical knowledge, and determine strategic investment opportunities for DoD/SERDP. This workshop is scheduled to be held in June 1999.

Consistent with past practice, the Executive Director solicited the advice of the membership regarding his proposed allocation of funds among the four Thrust Areas for FY 1999. The Board was fully supportive of the proposed profile and general trends of investment within each of the four Thrust Areas.

### *Project Recommendations*

During FY 1998, the SAB reviewed 54 proposals, 30 of which were New Start efforts and 24 of which were continuing projects. (See Table 2) Of these 54 proposals, 11 requested FY 1998 funds totaling \$9,527,000 and the remaining 43 projects requested \$31,589,000. The Board recommended against funding four proposals, totaling \$2,971,000. The SAB reviewed two Congressional interest projects, only one of which was recommended for funding (Green Energetics: PP-1115). A summary of all projects reviewed, the results of their deliberations, and comments associated with this review may be found in Appendix B.

Thrust Area	Number of Projects Reviewed			Funding Recommendation	
	Ongoing	New Start	Total	Fund	Do Not Fund
Cleanup	8	9	17	17	0
Compliance	6	5	11	8	3
Conservation	4	4	8	7	1
Pollution Prevention	6	12	18	18	0
TOTAL	24	30	54	50	4

**Table 2 - Summary of Proposals Reviewed by Thrust Area**

# **APPENDIX A**

**FY 1998 SAB MEMBERSHIP**



**Ryan, Michael, J. (SAB Chair)**

**Current Position:** Manager, Environmental Services, Bechtel Jacobs Company LLC.

**Degree(s):** Ph.D., Environmental Engineering, University of North Carolina, 1975.

**Previous Positions:** Manager, Technology, Bechtel Environmental, Inc.; Senior Vice President, Metcalf & Eddy Inc.; Executive Vice-President, ICF Technology, Inc.; Chief, Environmental Policy, U.S. Air Force (USAF) (Pentagon); Director, Environmental Engineering and Industrial Hygiene, Headquarters Strategic Air Command; Director, Environics Research and Development Program, AFESC.

**Professional Activities:** Consultant to the USAF Surgeon General; Member, USAF Engineering and Services "Future Vision" Panel; Professional Engineer (Texas); Board Certified Industrial Hygienist; Diplomate to American Academy of Environmental Engineers.

**Awards:** U.S. Patent on filtration.

**Publications:** Seventeen articles or other publications since 1985.

**Shreeve, Jean'ne M. (SAB Vice Chair)**

- Current Position:** Vice President for Research/Graduate Studies and Professor of Chemistry, University of Idaho.
- Degree(s):** Post Ph.D., University of Cambridge, England, 1967-1968; Ph.D., Inorganic Chemistry, University of Washington, 1961; M.S., Analytical Chemistry, University of Minnesota, 1956; B.A., Chemistry, University of Montana, 1953.
- Previous Positions:** Professor and Head, Department of Chemistry, University of Idaho, 1973-1987; Assistant Professor of Chemistry, University of Washington, 1962.
- Professional Activities:** EPSCoR, Idaho State Project Director, 1989-1999; Idaho Research Foundation, 1987-1999; University of Chicago Board of Governors of Argonne National Laboratory, 1992-1998; Council for Chemical Research Governing Board, 1995-1997; Visiting Committee, Naval Research Advisory Committee, Office of Naval Research, 1995; Board of Directors, American Association for the Advancement of Science, 1991-1995; Board of Directors, American Chemical Society, 1985-1993; National Science Foundation Advisory Committee for Chemistry, 1978-1982; Air Force Office of Scientific Research Proposal Evaluation Panel, 1972-1975.
- Awards:** Corresponding Member, Göttingen (Germany) Academy of Sciences, 1996; Harry and Carol Mosher Award, Santa Clara Valley Section (ACS), 1992; Honorary Doctor of Science, University of Montana, 1982; Alexander von Humboldt Foundation U.S. Scientist Award, Göttingen, 1978; American Chemical Society Award for Creative Work in Fluorine Chemistry, 1978; American Chemical Society Garvan Medal, 1972; Alfred P. Sloan Foundation Fellow, 1970-1972; Outstanding Achievement Award, University of Minnesota, 1970; National Science Foundation Postdoctoral Fellowship at Cambridge, 1967-1968; U.S. Honorary Ramsay Fellowship, 1967-1968.
- Publications:** Author of more than 290 scientific publications.

**Atkins, Patrick R.**

- Current Position:** Director, Environmental Affairs, Aluminum Company of America (ALCOA); Adjunct Professor, University of Pittsburgh.
- Degree(s):** Ph.D., Environmental Engineering, Stanford University, 1968; M.S. Environmental Engineering, Stanford University, 1965; B.S. Civil Engineering, Stanford University, 1964.
- Previous Positions:** Director, Environmental Control, ALCOA, 1980-1991; Chief Environmental Engineer, ALCOA, 1982-1984; Manager, Environmental Control, ALCOA, 1973-1980; Assistant Professor, Department of Environmental Health Engineering, University of Texas, 1968-1972.
- Professional Activities:** Member, American Society of Civil Engineers; Member, National Society of Professional Engineers; Member, Engineering Society of Western Pennsylvania; Member, Environmental Committees of the International Primary Aluminum Institute, the Business Roundtable Environmental Services Committee, National Association of Manufacturers, and other national and international groups; Registered Professional Engineer (Texas and Pennsylvania).
- Awards:** ALCOA Environmental Excellence Award, 1996; Paper of the Year (co-author), American Society of Civil Engineers, 1978.
- Publications:** Author of more than 50 technical articles and editor of two books.

**Bierbaum, Rosina M. (Represents Science Advisor to the President)**

- Current Position:** Associate Director for Environment, Environmental Division, Office of Science and Technology Policy, Executive Office of the President.
- Degree(s):** Ph.D., Ecology & Evolutionary Biology, State University of New York (SUNY) at Stony Brook; B.A., English and B.S., Biology, Boston College.
- Previous Positions:** Assistant Director for Environment, Office of Science and Technology Policy (OSTP); Senior Analyst, OSTP; Senior Associate, Office of Technology Assessment (OTA); Project Director for Climate Change, OTA; Assistant Project Director for Acid Rain, OTA; Congressional Fellow, OTA; Editorial Fellow, *The Quarterly Review of Biology*; Research Assistant, SUNY, Stony Brook.
- Professional Activities:** American Association for the Advancement of Science, Ecological Society of America, Sigma Xi; Editorial Board *Consequences*; National Science and Technology Council (NSTC) liaison to U.S. Global Change Research Program; Chair, Committee on Environment & Natural Resources, NSTC; Acting Chair, Environmental Monitoring Initiative Committee on Environmental & Natural Resources (CENR); Member, White House Ecosystem Management Implementation Task Force.
- Awards:** Distinguished Alumni Award, SUNY at Stony Brook, 1996; received OSTP Merit Awards 1994, 1995; awarded OTA's highest honor, Senior Associate, 1991; elected member Sigma Xi, 1985; Congressional Fellowship, 1980.
- Publications:** Primary author of *Changing by Degree: Steps to Reduce Greenhouse Gases*, 1991; *Preparing for an Uncertain Climate*, 1993; contributor to nine assessments on environmental issues published by OTA; co-authored and published numerous articles in technical and popular journals; testified before both House and Senate on environmental issues.

**Carpenter, Richard A. (Represents environmental public interest groups)**

**Current Position:** Environmental Consultant, Charlottesville, Virginia.

**Degree(s):** M.S., Organic Chemistry, University of Missouri, 1949; B.S., Chemistry, University of Missouri, 1948.

**Previous Positions:** Consultant to United Nations, World Bank, Asian Development Bank, 1980-present; Senior Fellow, East-West Center, Honolulu, Hawaii, 1977-1993; Executive Director, Commission on Natural Resources, U.S. National Research Council, 1972-1977; Founder and Chief, Environmental Policy Division, Congressional Research Service, Library of Congress, 1964-1972; Research for Callery Chemical Company (1958-1964), Midwest Research Institute (1951-1958), and Shell Oil Company (1949-1951).

**Professional Activities:** Member of Editorial Advisory Board, EIA Review, 1985-present; Co-Founder and Chairman of the Board (1991), Pacific Basin Consortium for Hazardous Waste Research; Study Director, Hawaiian Environmental Risk Ranking project, 1991-1992.

**Awards:** The Private Conservation Award, Virginia Chapter of The Nature Conservancy for Ecological Risk Assessment of Clinch Valley Bioreserve, 1996; elected full member of Sigma Xi, the Scientific Research Society, University of Missouri, 1949.

**Publications:** Several books, many professional papers, and patentee.

**Conway, Richard A.**

**Current Position:** Environmental Consultant.

**Degree(s):** M.S., Environmental Engineering, MIT, 1957; B.S., Public Health, University of Massachusetts - Amherst, 1953.

**Previous Positions:** Senior Corporate Fellow, Corporate Fellow, Development Associate, Group Leader, and Development Engineer, Union Carbide Corporation, 1957-1997.

**Professional Activities:** Member, National Academy of Engineering; Consultant and former Chair of Environmental Engineering Committee, Science Advisory Board, Environmental Protection Agency; Member, Board on Army Science and Technology and several study committees, National Research Council; Diplomate, American Academy of Environmental Engineers; Fellow, American Society of Civil Engineers; Member, advisory committees to several university research centers; Registered Professional Engineer.

**Awards:** Rachel Carson Award, Society of Environmental Chemistry and Toxicology, 1998; Award for Personal Achievement in Chemical Engineering, *Chemical Engineering*, 1986; Dudley Medal, ASTM, 1984; Rudolfs Award, Water Environment Federation, 1974, 1983; State-of-the-Art Civil Engineering Award, American Society of Civil Engineers, 1975; Hering Award, American Society of Civil Engineers, 1974; Gascoigne Award, Water Environment Federation, 1967.

**Publications:** One book, editor/co-editor of eight books, 21 refereed publications (numerous others), and three U.S. patents.

**Eno, Amos S. (Represents environmental public interest groups)**

**Current Position:** Executive Director, National Fish and Wildlife Foundation, Washington, DC.

**Degree(s):** M.A., Cornell University, 1977; B.A., Princeton University, 1972.

**Previous Positions:** Director, Conservation Programs, National Fish and Wildlife Foundation; Director, Wildlife Programs, National Audubon Society; Special Assistant to the Chief, Office of Endangered Species, U.S. Fish and Wildlife Service; Special Assistant to Assistant Secretary of the Interior for Fish, Wildlife, and Parks.

**Professional Activities:** Consultant/Production Assistant to National Audubon Society's TV specials and to WTBS for wildlife films; Consultant to President's Commission for Americans Outdoors; North American Wetlands Council; Director, North Atlantic Salmon Fund; Advisor WNET New York, "Nature's Trail."

**Awards:** Chevron Conservation Award, 1992; Frederick Douglas Prize, Princeton University, 1972.

**Publications:** FY89-96 (annual) Federal Agency Needs Assessments, four *Audubon Wildlife Reports*, and *Crossroads: Environmental Priorities for the Future*; co-author, *Wolf Recovery in the Northern Rocky Mountains*.

**Loehr, Raymond C.**

- Current Position:** Hussein M. Alharthy Centennial Chair and Professor of Civil Engineering, The University of Texas at Austin.
- Degree(s):** Ph.D., Sanitary Engineering, University of Wisconsin, 1961; M.S., Civil Engineering, Case Institute of Technology, 1956; B.S., Civil Engineering, Case Institute of Technology, 1953.
- Previous Positions:** Liberty Hyde Bailey Professor of Engineering, Cornell University; Professor, Cornell University, joint appointment-Department of Agricultural Engineering and Department of Environmental Engineering; Senior Program Manager, Hazardous Wastes, Environmental Research and Technology, Inc.; Director, Environmental Studies Program, College of Agriculture and Life Sciences, Cornell University; Program Advisor, Effluent Guidelines Division, U.S. Environmental Protection Agency, Washington, DC; Associate Professor and Professor, University of Kansas; Instructor and Assistant Professor, Case Institute of Technology.
- Professional Activities:** National Academy of Sciences, National Academy of Engineering, National Research Council Committees; Chair of Executive Committee, Science Advisory Board, Environmental Protection Agency; International Joint Commission, Science Advisory Board Committee, Phosphorous Management Strategies Task Force; Scientific Advisory Committee of the Advanced Environmental Control Technology Research Center, University of Illinois; Food and Agriculture Organization, United Nations; Advisory Committee, School of Civil and Environmental Engineering, Cornell University.
- Awards:** Thomas R. Camp Medal, Water Environment Federation, 1997; Gordon M. Fair Award, American Academy of Environmental Engineering, 1996; Rachel Carson Award, Society of Environmental Toxicology and Chemistry, 1995; T.H. Feng Distinguished Lecturer in Environmental Engineering, University of Massachusetts, Amherst, MA, 1994; Thomas R. Camp Lecture Award, Boston Society of Civil Engineers, American Society of Civil Engineers, 1992; Joe J. King Professional Achievement Award, The University of Texas at Austin, 1992; Billy and Claude Hocott Distinguished Centennial Engineering Research Award, The University of Texas, 1991; G. Brooks Earnest Lecture Award, Cleveland Section, American Society of Civil Engineers, 1991; Engineering Foundation Faculty Excellence Award, The University of Texas at Austin, 1987; Senior Fulbright-Hays Scholar, New Zealand, 1979; Rudolph Hering Medal, American Society of Civil Engineers, 1969; Water Conservationist of the Year, Kansas Wildlife Federation, 1967.
- Publications:** More than 220 technical publications since 1974.



**McCarty, Perry L.**

- Current Position:** Silas H. Palmer Professor of Civil Engineering, Stanford University; Director, Western Region Hazardous Substance Research Center, Stanford University.
- Degree(s):** Eng. D., Colorado School of Mines, 1992; Sc.D., Sanitary Engineering, Massachusetts Institute of Technology, 1959; S.M., Sanitary Engineering, Massachusetts Institute of Technology, 1957; B.S., Civil Engineering, Wayne State University, 1953.
- Previous Positions:** Chairman, Department of Civil Engineering, Stanford University, 1980-1985; Professor of Civil Engineering, Stanford University, 1967-1975; Associate Professor of Civil Engineering, Stanford University, 1962-1967; Assistant Professor of Sanitary Engineering, Massachusetts Institute of Technology, 1958-1962.
- Professional Activities:** Member, Commission on Geosciences, Resources, and Environment, National Academy of Sciences/National Research Council, 1994-present; Member, Board on Radioactive Waste Management, National Academy of Sciences/National Research Council, 1989-present; Member, Research Council, Water Environmental Federal Research Foundation, 1989-present; Chairman, Committee on Remedial Action Priorities for Hazardous Waste Sites, National Academy of Sciences/National Research Council, 1991-1994.
- Awards:** Fellow, American Academy of Microbiology, 1993; Tyler Prize for Environmental Achievement, 1992; Founder's Award for Sustained and Outstanding Contributions to Environmental Engineering Education, AEPP, 1992; Engineering-Science Research Award, 1979, 1983, 1992; A.P. Black Research Award, American Water Works Association, 1989; Honorary Member, WPCF, 1989; Outstanding Publication Award, AEPP, 1985, 1988; Member, National Academy of Engineering, 1977.
- Publications:** More than 280 publications in total, 37 publications plus five patents during the past three years.

**McClellan, Roger O.**

- Current Position:** President, Chemical Industry Institute of Toxicology; Adjunct Professor, Duke University Medical Center, North Carolina State University, University of North Carolina, University of New Mexico, and Washington State University.
- Degree(s):** Doctor of Veterinary Medicine (with Highest Honors), Washington State University, 1960; Master of Management, University of New Mexico, 1980.
- Previous Positions:** President and Director, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, 1976-1988; Vice President and Director of Research Administration and Director, Inhalation Toxicology Research Institute, Lovelace Foundation for Medical Education and Research, 1973-1978; Director, Fission Product Inhalation Program, Lovelace Foundation for Medical Education and Research, 1966-1973; Scientist, Division of Biology and Medicine, U.S. Atomic Energy Commission, 1965-1966; Senior Scientist and Biological Scientist, Hanford Laboratories, General Electric Company, 1959-1964.
- Professional Activities:** Chair and Member, Clean Air Scientific Advisory Committee, 1987-1994, Research Strategies Advisory Committee, 1992-present, and Executive Committee, 1974-1994, Science Advisory Board, U.S. Environmental Protection Agency; Member, Advisory Council for Center for Risk Management, Resources for the Future, 1987-present; Committee Chair and Member, National Council on Radiation Protection and Measurements, 1971-present; Chair and Member, National Academy of Sciences/National Research Council Committee on Health Risks of Exposure to Radon, 1994-1996, Committee on Risk Assessment for Hazardous Air Pollutants, 1991-1994, and Committee on Toxicology, 1979-1987; President, American Association for Aerosol Research 1992-1993; Member, Health Research Committee, Health Effects Institute, 1981-1992; President, Society of Toxicology, 1985-1986; Editor, CRC Critical Reviews in Toxicology.
- Awards:** Honorary Member and Ambassador of Toxicology, Mid-Atlantic Chapter of Society of Toxicology, 1995; Fellow, Society for Risk Analysis, 1992; Elected Member, Institute of Medicine, National Academy of Sciences, 1990; Fellow, American Association for the Advancement of Science, 1981; Honorary Fellow, The Academy of Toxicological Sciences, 1991; Frank R. Blood Award, 1989, and Arnold J. Lehman Award, 1992, Society of Toxicology; Career Achievement Award, Society of Toxicology Inhalation Specialty Section, 1989; Distinguished Associate Award, Department of Energy, 1987 and 1988; Alumni Achievement Award, Washington State University, 1987; Herbert E. Stokinger Award, American Conference of Governmental Industrial Hygienists, 1985.
- Publications:** Author or co-author of more than 250 publications.

**Thomas, Lydia W.**

**Current Position:** President and Chief Executive Officer, Mitretek Systems, Inc.

**Degree(s):** Ph.D., Cytology, Howard University, 1973; M.S., Microbiology, American University, 1971; B.S., Zoology, Howard University, 1965.

**Previous Positions:** Senior Vice President and General Manager, Center for Environment, Resource and Space, Mitretek Systems, Inc., 1989-1996.

**Professional Activities:** American Association for the Advancement of Science; American Society of Toxicology; American Defense Preparedness Association; American Institute of Aeronautics and Astronautics/Public Policy; American Management Association; The Conference Board; National Energy Resources Organization; Sigma Xi Steering Committee; Teratology Society; Superintendent's Business/Industry Advisory Council for Fairfax County Public Schools; United States Energy Association; Serves on the Board of Directors of Cabot Corporation and advisory boards of INFORM and George Washington University's Virginia Campus; Corporate Member of the Charles Stark Draper Laboratory, Inc.

**Awards:** Dean's Award at the Black Engineer of the Year Conference, 1991; "Ebony" Image Award presented by The Coalition of 100 Black Women, Northern Virginia Chapter, for outstanding achievement in the public service, 1990; TWIN Award (Tribute to Women in International Industry) presented by the Young Women's Christian Association, National Board, 1986.

**Publications:** Co-Authored one book and has written many technical reports -- the most recent printed in FIRST Magazine, Volume 9, Number 3, 1996, titled "Future World Energy Demand."

**Ward, C. Herb**

- Current Position:** Foyt Family Chair of Engineering, Professor of Environmental Science and Engineering and of Ecology and Evolutionary Biology, Rice University; Director, Advanced Applied Environmental Technology Demonstration Facility, U.S. Department of Defense; Director, Energy and Environmental Systems Institute, Rice University; Co-Director, Hazardous Substances Research Center - South and Southwest (LSU, Rice, Georgia Tech), U.S. EPA Superfund Research Center; Director, National Center for Ground Water Research, Rice University, U.S. EPA Exploratory Research Center of Excellence, Director, Superfund University Training Institute, Rice University, U.S. EPA Office of Solid Wastes and Emergency Response; Adjunct Professor, The University of Texas School of Public Health.
- Degree(s):** M.P.H., Environmental Health, The University of Texas, 1978; Ph.D., Plant Pathology - Physiology, Cornell University, 1960; M.S., Plant Pathology - Genetics, Cornell University, 1958; B.S., Biology, New Mexico State University, 1955.
- Previous Positions:** Professor and Chair, Department of Environmental Science and Engineering, Rice University, 1970-1992; Visiting Professor, The University of Texas School of Public Health, 1973-1974; Associate Professor, Department of Chemical Engineering (1966-1968) and Environmental Science and Engineering Program (1968-1970), Rice University; Physiologist and Director, Bioregenerative Life Support Systems Research, USAF School of Aerospace Medicine, 1963-1966; Research Scientist, USAF School of Aerospace Medicine, 1960-1963.
- Professional Activities:** Committee Chair and Member, National Academy of Science, National Academy of Engineering, and National Research Council, 1975-present; Committee Chair and Member, U.S. Environmental Protection Agency Science Advisory Board, 1987-present; Member, U.S. Department of Defense Strategic Environmental Research and Development Program (SERDP) Bioconsortium Science Advisory Committee, 1997-present and National Environmental Technology Test Sites Program Review Panel, 1994-1996; Consultant, Environmental Sciences Program, University of New Orleans, 1995; Board of Directors, American Type Culture Collection, 1987-1990; Chair, Committee on Special Science Programs, American Institute of Biological Sciences, 1978-1983, 1985-1990.
- Awards:** Fellow, American Academy of Microbiology, 1994; Controlled Ecological Life Support Systems Award, NASA, 1993; Distinguished Service Award, Society of Environmental Toxicology and Chemistry, 1990; Charles Porter Award, Society for Industrial Microbiology, 1986; Achievement Award, NASA, 1981.
- Publications:** Author or co-author of more than 200 publications and 13 books.

**Winokur, Robert S. (Represents Administrator, NOAA)**

**Current Position:** Assistant Administrator, Satellite and Information Services, National Oceanic and Atmospheric Administration, Department of Commerce.

**Degree(s):** M.S., American University; B.S., Rensselaer Polytechnic Institute.

**Previous Positions:** Technical Director, Office of the Oceanographer of the Navy; Senior Civilian Technical Manager, Navy Operational Oceanography Program; Associate Technical Director, Ocean Science and International Programs, Office of Naval Research; Director, Planning and Assessment, Office of Naval Research; Deputy and Special Advisor, Office of the Deputy Assistant Secretary of the Navy for Antisubmarine Warfare; Special Assistant for Acoustics to the Director, Antisubmarine Warfare and Surveillance Programs, Office of the Chief of Naval Operations; Branch Head and Division Director, Naval Oceanographic Office.

**Professional Activities:** Fellow, Acoustical Society of America; Former Vice President Technical Affairs, Marine Technology Society.

**Awards:** Presidential Distinguished Executive and Meritorious Rank Awards for Senior Executives.

**Publications:** Numerous papers and reports on underwater acoustics and naval oceanography.

**Wood, Randolph (Represents the interests of state governments)**

**Current Position:** Director, Nebraska Department of Environmental Quality.

**Degree(s):** M.S., Engineering, Southern Methodist University; B.S., Engineering, University of Texas.

**Previous Positions:** Director, Arizona Department of Environmental Quality; Director, Wyoming Department of Environmental Quality; Supervisor, Source Testing Section, Texas Air Control Board; Engineer, General Dynamics Corporation.

**Professional Activities:** President, STAPPA (organization of Air Pollution Control Administrators); Board of Directors, STAPPA; Executive Secretary, Wyoming Governor's Acid Rain Coordinating Committee; Editorial Advisory Board, *The Environmental Forum*.

**Awards:** Tribute of Appreciation Award from EPA Administrator for air pollution control efforts, 1984; Citizen Participation Award from EPA Administrator for air pollution control efforts, 1980.

# **APPENDIX B**

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Project No.	Recommendation				FY98 Meeting Date						New Starts	Continuing Projects
	Funded		Not Funded		1	2	3	4	5	6		
	FY98	FY99	FY98	FY99	Oct-97	Jan-98	Mar-98	Jun-98	Aug-98	Sep-98		
					Cleanup Thrust Area							
CU-368		\$ 1,600					Mar-98					•
CU-720		\$ 2,250					Mar-98					•
CU-1070		\$ 1,000					Mar-98					•
CU-1073		\$ 530					Mar-98					•
CU-1080	\$ 395					Jan-98						•
CU-1081		\$ 780						Jun-98				•
CU-1090	\$ 345				Oct-97						•	
CU-1093		\$ 330								Sep-98		•
CU-1121		\$ 402							Aug-98		•	
CU-1122		\$ 307							Aug-98		•	
CU-1123		\$ 283							Aug-98		•	
CU-1124		\$ 317							Aug-98		•	
CU-1125		\$ 350							Aug-98		•	
CU-1127		\$ 370							Aug-98		•	
CU-1128		\$ 480								Sep-98	•	
CU-1129		\$ 514								Sep-98	•	
NETTS		\$ 2,190						Jun-98				•
					Conservation Thrust Area							
CS-1054	\$ 430	\$ 600					Mar-98					•
CS-1082		\$ 370						Jun-98				•
CS-1088#						Jan-98						•
CS-1096	\$ 575				Oct-97						•	
CS-1098	\$ 1,000	\$ 1,050				Jan-98		Jun-98			•	•
CS-1130			\$ 490							Sep-98	•	
CS-1131		\$ 545								Sep-98	•	
					Compliance Thrust Area							
CP-819*			\$ 1,500					Jun-98				•
CP-1060	\$ 1,040	\$ 910					Mar-98					•
CP-1078		\$ 300						Jun-98				•
CP-1079		\$ 450						Jun-98				•
CP-1105		\$ 570								Sep-98		•
CP-1106		\$ 989								Sep-98		•
CP-1108	\$ 411				Oct-97						•	
CP-1120		\$ 262							Aug-98		•	
CP-1126		\$ 259							Aug-98		•	
CP-1132			\$ 500							Sep-98	•	
CP-1136			\$ 481							Sep-98	•	
					Pollution Prevention Thrust Area							
PP-867		\$ 300					Mar-98					•
PP-1056		\$ 950					Mar-98					•
PP-1058		\$ 1,330					Mar-98					•
PP-1059		\$ 3,500							Aug-98			•
PP-1109	\$ 692	\$ 1,007			Oct-97			Jun-98			•	•
PP-1112	\$ 439				Oct-97						•	
PP-1113		\$ 890						Jun-98				•
PP-1115*	\$ 2,700							Jun-98			•	
PP-1117		\$ 367							Aug-98		•	
PP-1118		\$ 334							Aug-98		•	
PP-1119		\$ 500							Aug-98		•	
PP-1133		\$ 600								Sep-98	•	
PP-1134		\$ 595								Sep-98	•	
PP-1135		\$ 731								Sep-98	•	
PP-1137		\$ 268								Sep-98	•	
PP-1138		\$ 497								Sep-98	•	
PP-1139		\$ 241								Sep-98	•	
TOTALS	\$ 8,027	\$ 30,118	\$1,500	\$1,471							30	24

\* Congressional Interest Item

# Informational Brief

## Cleanup Thrust Area

***Title:***

CU-368: Aquifer Restoration by Enhanced Source Removal

***Performer:***

Environmental Protection Agency (EPA): National Risk Management Research Lab

***Requested Funding:***

\$1,600K (FY99 Continuing Project)

***Summary:***

The goal of this project is to provide field demonstrations of innovative processes to remediate aquifers contaminated by non-aqueous phase liquids (NAPLs) including fuels, solvents, and other organic contaminants in a timely and cost-effective manner. These demonstrations are targeted at the Department of Defense (DoD), the Department of Energy (DOE), the EPA, their contractors, and other public and private organizations responsible for remediation of contaminated groundwater. Low-solubility organics such as chlorinated solvents were used and released to the environment in massive quantities during the 1950s, 60s, and 70s. These contaminants have migrated through the subsurface and entered groundwater at over 2,000 DoD sites. The project, initially funded by SERDP in FY93, intends to continue efforts planned through demonstrating (in the field at Dover Air Force Base) the effectiveness of emerging dense non-aqueous phase liquid (DNAPL) source removal technologies using side-by-side comparisons in controlled experiments and to compare the performance of each to "pump and treat" technology.

***Recommendation:***

(March) Raising questions comparing the current DNAPL source removal efforts under the project to the previous efforts involving light non-aqueous phase liquids (LNAPL) at Hill Air Force Base in Utah, Board members inquired as to the status and schedule of reports on the various studies performed and to be performed under the project. Stressing the value of being able to compare contaminant removal technologies, the Board suggested the inclusion of a comparative analysis as part of the final project deliverable, and emphasized the completion and publication of the studies earlier than scheduled to improve the state-of-the-science in DNAPL contaminant removal, and thus have more of an effect on DNAPL remediation. The Board raised questions regarding efforts to develop adequate comparative analyses between the proposed techniques and currently practiced remediation techniques. Specifically, Board members stressed the importance of ensuring that the researchers focus on: (1) developing adequate cost comparisons; (2) evaluating the time requirements of the new techniques to reach remediation levels; and, (3) addressing the impact subsurface heterogeneity that would likely control the process. The Board moved to recommend approval of the project's FY99 funding request. The motion was approved by a vote of 8-0 with one abstention.

**Title:**

CU-720: Integrated Biotreatment Research Consortium: Flask to Field Initiative

**Performer:**

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

**Requested Funding:**

\$2,250K (FY99 Continuing Project)

**Summary:**

This multi-university/Federal laboratory project, initially funded by SERDP in FY94, seeks to continue its efforts to: (1) develop field implementable, cost-effective bioremediation technologies; (2) produce at least one field-ready biotreatment technology for each contaminant group; (3) develop treatment systems that are better oriented toward contaminated soil and groundwater treatment; and (4) increase understanding of process mechanisms and limitations.

**Recommendation:**

(March) The Board asked about the establishment of the Technical Advisory Committee (TAC), the TAC's role within the project, and the recent impact of the TAC Report on the course and objectives of the project. Board members inquired as to how funds were withdrawn from those projects graded as unacceptable by the TAC and redistributed to other bioremediation efforts, and opined that preferential treatment should not be given to those members of the consortium recently rejected by the TAC Report. Offering endorsements of the TAC's efforts thus far in serving as a valuable downselect tool, the Board reached consensus supporting the continued downselect of research options to focus the project's research dollars to those research efforts and performers that the TAC deems to be better than the others. Considering the issues raised and voicing support for the project, Board members challenged the consortium and its director to keep focus of the project and its researchers on the publication of its research results. The Board moved to recommend approval of this project at the requested funding level in FY99. The motion was approved by a vote of 8-0.

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**Title:**

CU-1070: Low-Frequency, Ultra-Wideband Boom Synthetic Aperture Radar (Boom-SAR) for Remote Detection of Unexploded Ordnance (UXO)

**Performer:**

U.S. Army Research Lab

**Requested Funding:**

\$1,000K (FY99 Continuing Project)

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**Summary:**

The goal of this continuing project is to: (1) determine the applicability of low-frequency, ultra-wideband synthetic aperture radar (SAR) for detecting and discriminating surface and subsurface UXO; (2) refine and validate electromagnetic models that can be used to extrapolate UWB SAR performance to other environmental conditions (soils); and (3) develop detection algorithms for separating UXO from clutter.

**Recommendation:**

(March) Inquiring about possible limitations of the proposed detection technology, Board members voiced concerns regarding the impact of differing topography and soil type on the performance of the system and about environmental constraints. The Board questioned the role of the Boom-SAR technology in relation to the overall UXO detection effort. The Board moved to recommend approval of FY99 funding for the project. The motion was approved by a vote of 9-0.

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**Title:**

CU-1073: Using Mode of Action to Assess Health Risks from Mixtures of Chemical/Physical Agents

**Performer:**

Pacific Northwest National Laboratory

**Requested Funding:**

\$530K (FY99 Continuing Project)

**Summary:**

The primary objectives of this continuing project are to: (1) conduct research to provide the data required to assess the risks from mixtures of chlorinated solvents in hazardous waste sites and contaminated groundwater; and (2) test the hypothesis that modes of action can be used to predict interactions between carcinogens.

**Recommendation:**

(March) Voicing concerns regarding the technical approach of the project, the Board questioned the choice of the chlorinated solvent metabolites that were the focus of the study, as well as the choice of the type of mouse that is to be used in the tumor studies. Citing the type of mouse, the B6C3F1, to be used in the study as a poor model, Board members expressed doubts regarding the level of confidence of the results when extrapolating the tumor development in mice in calculations to determine the risk to human health. Board members voiced further concerns about the possible misuse of the data regarding linear, no-threshold risk models, and stressed that reports produced under this study need to highlight the relatively high exposure concentration levels to ensure the results would be reviewed in the proper context. Reinforcing these context issues, other Board members added that the doses utilized in the study may be at too high a level to be fully relevant to situations of low exposure, and suggested that any results from the project will require careful wording to ensure that they receive the proper perspective and reduce the chances of their misuse. With consideration of the concerns raised, the Board moved to recommend

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approval of the project for FY99 funding with the recommendation that: (1) project reports produced under the project should provide the appropriate context for the research observations with the goal of providing the best possible scientific foundation for assessing human health risks from exposure; and (2) the aforementioned context should address issues associated with interspecies differences, different metabolic responses, and magnitude of concentration levels used in the experiments relative to expected real world exposures. The Board approved the motion with the inclusion of the suggestions voiced by a vote of 9-0.

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***Title:***

CU-1080: Value-Added Site Monitoring and Infrastructure Maintenance for In-Situ Bioremediation

***Performer:***

University of Michigan

***Requested Funding:***

\$395K (FY98 Continuing Project)

***Summary:***

The objectives of this project is to: (1) provide serial monitoring of intrinsic (i.e., natural) bioremediation processes at Wurtsmith Air Force Base fuel and solvent contaminated sites near Oscoda, Michigan; (2) maintain and supplement bioremediation data collection for Relational Database Management System (RDBMS) users; and (3) conduct statistical data analyses to evaluate sources of spatial and temporal hydrogeologic and concentration variability, improve estimates of contaminant removal rates, and develop indicators of bioremediation process change.

***Recommendation:***

(June) While supporting the goals of the project, the Board expressed concerns regarding the proper focus of the data collection. Conceding the clear need for more extensive databases and good quality databases, Board members stressed the importance of having the right hypotheses to collect the right data, and reinforced the need for assurances from the project that proper coordination with the research community was being maintained to ensure that the proper ranges of data are being collected for input to inherently complex chlorinated solvent degradation models. Expressing mixed feelings about the project, Board members questioned whether the project was a true research project or was simply an extension of existing monitoring, and requested that the Principal Investigator (PI) provide in writing the scientific hypothesis or hypotheses that would be tested under the scope of the project. Voicing other concerns, Board members agreed that the project had identified remediation questions in need of answers, but expressed doubts that the project, as presently structured, was focused on finding those answers.

With consideration of these concerns, the Board moved to approve FY98 funding for the project, with the requirement that the project return and answer the questions raised. The Board went on to encourage expanded involvement of other users within the scope of the project and provide the Board within two months a written response to address the issues raised and reflect a better understanding of the research parameters and the data sets and how they are used by modelers. Clarifying the earlier requests, the Board

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stated that the written response should include: (1) the research hypothesis underpinning the project; and (2) a preliminary analysis of how the effort will add value to the Department of Defense. With the inclusion of these amendments, the motion was approved by a vote of 11-0.

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***Title:***

CU-1081: Genosensor-Based Ecotoxicity Response Assessment

***Performer:***

Oak Ridge National Laboratory

***Requested Funding:***

\$780K (FY99 Continuing Project)

***Summary:***

The objective of this project is to develop cost-effective methods and instrumentation for directly monitoring genotoxic exposure in a variety of natural ecosystems. Direct measurements of the in-situ biological responses associated with genotoxic exposure of sentinel species in the environment circumvents the difficult problem of bioavailability, because measurable molecular endpoints in resident species are a direct reflection of ecologically relevant exposure. This project will implement emerging biochip technology for in-situ monitoring of molecular endpoints of genotoxic exposure, including DNA damage-inducible gene expression pathways, in soil and water ecosystems. The long-term aim of the project is to install and operate genosensor systems at Oak Ridge National Laboratory (ORNL) and the U.S. Army Corps of Engineers Waterways Experiment Station (WES) for use in ecological risk assessment in support of cleanup activities for the Department of Energy (DOE) and the Department of Defense (DoD).

***Recommendation:***

(June) The Board questioned the actual extent of the technology's application in a real world setting even if the technology is successfully developed in the lab. Board members generally conceded that the proposed research represented good science; however, the inferences made from changes in the microbial population that would be detected by the genosensor were called into question. Emphasizing that genosensor research was a promising technology, Board members expressed concerns whether the application had a clearly defined path to achieve success, whether the proposed application was addressing a DoD need, and whether the application was feasible at all in a real world setting. Conceding the limitations and deficiencies that the Board identified regarding the unclear application of the technology, some Board members opined that the project was an elegant tool that represented the first scientific investigation step along the path.

With consideration of the concerns raised, the Board moved to recommend approval of the FY99 funding for the project, with the requirement that: (1) the Principal Investigator (PI) organize an end-user group to: (a) identify potential customers for the technology; (b) identify potential DOE/DoD operational applications; and (c) conduct periodic review during the year to ensure the project focus is maintained; and (2) the project return to rebrief the SAB in FY99 and answer the questions raised. Board members also

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expressed a desire to have the co-performers from the U.S. Army Corps of Engineers WES address the Board to better explain the intended application of the technology, with a specific suggestion to have individuals from WES—preferably functional managers of technology needs—on hand at a future meeting to articulate how results of this research will be used to ensure there will be useful application(s). Once seconded, the Board approved the motion with requirements by a vote of 6-5 and included one Board member's proxy for approval left before departure.

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***Title:***

CU-1090: Integrated Geophysical Multi-Sensor Detection of Dense Non-Aqueous Phase Liquids (DNAPL) Source Zone Identification

***Performer:***

Blackhawk Geometrics, Inc.

***Requested Funding:***

\$345K (FY98 New Start)

***Summary:***

The project approach is to obtain the maximum information on the geological environment using computational geophysics and statistical data interpretation to combine seismic and electrical techniques that will extend 2-D capabilities to high resolution 3-D. Sensors will be placed first on the ground surface and then within existing monitoring wells and/or temporary, minimally invasive cone penetrometer (CPT) implants. Complementary direct imaging of dense non-aqueous phase liquids (DNAPL) distribution will be provided by induced polarization (IP) crosshole tomography using the same downhole electrical sensors.

***Recommendation:***

(October) The Board raised several concerns regarding the project's technical approach during the rebrief for FY98 funding approval. Regarding the discrimination aspects of the detection capabilities of sensors and the likelihood or expectation of false positives, Board members inquired whether other non-DNAPL chemicals would give similar responses. Similar to the detection sensitivity concerns from the September 1997 meeting, Board members expressed concerns regarding the ability of the IP technique to detect residual DNAPLs at low levels, which is of interest and a challenge to the environmental restoration community. Other Board members questioned the usefulness of the technology, expressing scepticism at the notion that researchers would encounter many DNAPL field sites at levels needed for adequate detection. Other Board members commented regarding the extent of the DNAPL problem at Department of Defense (DoD) sites, and that despite the concerns raised, the project appeared to be a relatively good risk with relatively low investment of funds in an attempt to fill a technology void in DNAPL source zone detection.

With consideration of the detection sensitivity concerns raised, the Board moved to approve FY98 funding for the project, with the requirement that the project focus the first year on determining the DNAPL detection sensitivity. The Board requested that: (1) the project develop a test protocol to perform a proof-of-concept with respect to the ability of the IP method to detect DNAPL; (2) this proof-of-concept

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should be performed at a well-defined site with the intent to define the boundaries of the IP method; and (3) the rest of the project would be deferred until a successful demonstration of the abilities of the IP method. In the absence of a quorum, the motion with requirements was approved by a vote of 6-0, and included a proxy left by one Board member. This vote was later ratified 10-1 with one abstention by a quorum via telefax.

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***Title:***

CU-1093: In-Situ Clay Formation: A New Technology for Stable Containment Barriers

***Performer:***

Sandia National Laboratory

***Requested Funding:***

\$330K (FY99 Continuing Project)

***Summary:***

The project's technical objectives are threefold: (1) confirm published results suggesting that clays can be precipitated from aqueous gels in a few weeks to months; (2) design an optimum composition of aqueous gel solution for maximum clay yield and crystallization rate, while maintaining injectability into porous soils and sediments; and (3) test the method in "sandbox" experiments in the laboratory to obtain a significant reduction in permeability and increase in geomechanical stability prior to a field test.

***Recommendation:***

(September) Board members voiced concern regarding the outyears of the project, specifically that the budget for the outyears needs to be critically reviewed. Board members voiced concern regarding the decrease in funding for the University of Colorado performers in the outyears during the field demonstration and made a suggestion to keep the university performers more involved during the field test stage of the project. Some Board members commended the performers on the excellent progress achieved in the four months since the SERDP funding was received. The Board moved to recommend approval of the project's request for FY99 funding. In the absence of a quorum, the vote was 4-0 for approval of the motion. (This vote was later ratified via telefax by a vote of 9-0-1 for the recommendation for FY99 funding, with one Board member abstaining.)

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***Title:***

CU-1121: Processing Techniques for Discrimination Between Buried Unexploded Ordnance (UXO) and Clutter Using Multisensor Array Data

***Performer:***

AETC, Inc.

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***Requested Funding:***

\$402K (FY99 New Start)

***Summary:***

The project's technical objectives are to develop a reliable technique for discriminating between buried UXO and clutter using multisensor electromagnetic induction sensor array data. The effort intends to build on existing research to exploit differences in shape between ordnance and clutter to include the effects of other distinctive properties of ordnance items (fuze bodies, driving bands, fin assemblies, etc.). Specifically, the project intends to perform tests in the less than 100 KHz domain.

***Recommendation:***

(August) Board members raised questions regarding the experimentation with the Neural Raman Technique and expressed concern that the project's focus had changed in response to peer reviewer's comments and possible new problems that could exist. Board members were concerned that the interpretation of geophysical data is an "art," and questioned the confidence in the ability to distinguish UXO from clutter, and that the amount of data that would be generated in determining UXO from other fragments of metal, could possibly overload the project. The Board raised issues regarding the project's deliverables, and that the data needs to be provided to the risk management community to help develop risk models. A Board member questioned if the project would be used to improve UXO sensors and if the data would be delivered to the sensor development community. The Board moved to recommend approval of the project's request for FY99 funding, with the requirement that SERDP staff report back to the Board on the status of the go/no-go decisions in FY99. The motion was approved by a vote of 8-0.

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***Title:***

CU-1122: Unexploded Ordnance (UXO) Discrimination by Mid-Frequency Electromagnetic Induction

***Performer:***

U.S. Army Cold Regions Research and Engineering Laboratory

***Requested Funding:***

\$307K (FY99 New Start)

***Summary:***

The project's technical objectives are to perform electromagnetic surveys and data processing of UXO targets in the 25 KHz to 300 KHz domains, with particular reference to environmental and clutter issues. Some sensing work has been attempted that includes the mid-frequency (MF) frequency domain, striving for high resolution sensing over the very broad 30 KHz to 30 MHz bands.

***Recommendation:***

(August) Board members raised doubts regarding the value of the project, specifically questioned whether there would be stable, repeatable results. Board members raised issues with the project's intention to understand how to create a model based on the composition of the UXO material, specifically that the heterogeneity of UXO was not fully understood and the process of making a model could not be explored without data to explain the process. Board members further questioned the use of higher frequencies and how they propagate in soils. Regarding the go/no-go decisions for FY99, Board members questioned the program plan for FY99 and asked for clarification to determine if the go/no-go decision is dependant on success of both the engineering and modeling solutions, specifically if one is successful and the other is not, which one would drive the go/no-go decision. The Board moved to recommend approval of the project's request for FY99 funding, with the requirement that SERDP staff report back to the Board on the status of the go/no-go decisions for FY99. The motion was approved by a vote of 8-0.

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***Title:***

CU-1123: Statistical Signal Processing with Physics-Based Models: Multisensor Unexploded Ordnance (UXO) Detection and Identification

***Performer:***

Duke University

***Requested Funding:***

\$283K (FY99 New Start)

***Summary:***

The project's technical objective is to undertake rigorous phenomenological modeling of electromagnetic wave propagation and scattering at ultra-wideband radar and electromagnetic induction frequencies (20-1200 MHZ and 0.1-100 KHz, respectively), during which the researchers seek to delineate those phenomenological features that most discriminate UXO targets from anthropic clutter.

***Recommendation:***

(August) Board members inquired into the difficulty of obtaining the data sets needed for the modeling. The Board questioned the credentials the proposing academic institution has relating to this type of work. The Board moved to recommend approval of the project's request for FY99 funding, and the motion was approved by a vote of 8-0.

**Title:**

CU-1124: An Innovative Passive Barrier System Using Membrane-Delivered Hydrogen Gas for the Bioremediation of Chlorinated Aliphatic Compounds

**Performer:**

University of Minneapolis

**Requested Funding:**

\$317K (FY99 New Start)

**Summary:**

The project's technical objective is to examine the gas transfer behavior and performance of hollow fiber membrane curtains installed as passive barriers. The proposed research will assess the suitability and effectiveness of the membrane for delivering hydrogen to accelerate the in-situ remediation of chlorinated organic compounds like carbon tetrachloride, chloroform, trichloroethene, and perchloroethylene.

**Recommendation:**

(August) The Board questioned the extent of any existing commercial membrane systems for bacterial applications despite years of research. The Board raised questions regarding delivery of the hydrogen gas, stressing the apparent difficulty in introducing hydrogen gas uniformly to groundwater. Referring to diffusion limitations, a Board member opined that the technology would result in uneven distribution of hydrogen. Another concern of the Board is the issue of bacterial competition for the hydrogen, and the Board questioned a clear Go/No-Go decision point that would entail evaluation (with real world samples) of the various competitors for hydrogen. The Board wanted assurance that at the biofilm the halorespirators would be able to degrade the contaminants as proposed, and that the sample should be very active with a mixed population to ensure a useful result. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding for the project, and the motion was approved by a vote of 4-1. This vote was later ratified in the presence of a quorum by a vote of 6-1, with an amendment to the original motion to require a formal project rebrief in FY99 prior to receipt of FY00 funds.

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**Title:**

CU-1125: Influence of Groundwater Constituents on Longevity of Iron-Based Permeable Barriers

**Performer:**

Johns Hopkins University

**Requested Funding:**

\$350K (FY99 New Start)

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**Summary:**

The project's technical objective is to predict the long-term performance of iron-based permeable barriers used for in-situ treatment of organic or metal-contaminated groundwaters. Particular emphasis will be placed on developing new approaches for "real-time" monitoring of changes in system performance through a novel electrochemical probe that can be installed in-situ in pilot or full-scale applications.

**Recommendation:**

(August) Regarding the probe that will be used in-situ, Board members questioned the function of the probe and how it would be used with varying rates of groundwater flow. Board members also expressed concern about the ability to calibrate the probe after being in-situ for many years. Board members raised concerns over the detention time of the groundwater flow in the wall versus contact with the probe. The Board needed assurance that the laboratory studies do mimic the field with the range of designs, installations, flow velocities, and wall gates, in order to build a probe that will work on a range of real world situations. The Board moved to recommend approval of the project's request for FY99 funding, and the motion was approved by a vote of 8-0.

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**Title:**

CU-1127: Development of Effective Aerobic Cometabolic Systems for the In-Situ Transformation of Problematic Chlorinated Solvent Mixtures

**Performer:**

U.S. Air Force Research Laboratory

**Requested Funding:**

\$370K (FY99 New Start)

**Summary:**

The project's technical objectives are to demonstrate the potential use of propane- and butane-utilizing microorganisms to transform problematic chlorinated aliphatic hydrocarbon (CAH) mixtures. The demonstration will be aimed toward creating in-situ bioreactive passive barriers in contaminated aquifers.

**Recommendation:**

(August) Board members raised issues with the nature of the proposed passive barrier system. A Board member questioned the project's definition of passive and opined that the project would fall into a category of active barrier treatment because of the amount of equipment that is necessary to provide a favorable environment for the bacterium that is used to treat the groundwater plume. Board members raised issues regarding the complexity of the problem and that there may not be any remediation taking place in the groundwater plume over the duration of the project. Board members voiced concerns that mixture issues were not a main focus of the project. The Board moved to recommend approval of the project's request for FY99 funding, and the motion was approved by a vote of 6-0-1, with one Board member abstaining based on involvement with the project.

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**Title:**

CU-1128: Nonintrusive Characterization of Dense Non-Aqueous Phase Liquids (DNAPLs) Using Short-Lived Radiotracers in Partitioning Interwell Tracer Tests

**Performer:**

Pacific Northwest National Laboratory

**Requested Funding:**

\$480K (FY99 New Start)

**Summary:**

The project's technical objective is to develop a partitioning interwell tracer test using short-lived radioisotopic tracers as an effective characterization technique for DNAPL in the saturated zone. By injecting both conservative and partitioning short-lived radioisotopic tracers into the subsurface and continuously measuring their presence in monitoring wells with moveable downhole detectors, the location and amount of DNAPL may be determined to a much greater extent than can be achieved by any other method.

**Recommendation:**

(September) The Board expressed concerns that any patents or other intellectual property rights on the proposed technique may inhibit writing an effective guidance manual and not allow the government full use for future remediation projects. The Board expressed concern that implementation of the radio tracers could be costly and questioned whether these costs would be recovered. Board members questioned how one ensures that the injected tracers would be received and suggested that to strive to get more results for our SERDP dollars, the project should work with actual site remediation projects. Some Board members expressed a concern that there were no on-site contractors on the team who are familiar with the Hill Air Force Base site. The Board also questioned who would be doing the field work for the project and suspected that there might be supply and logistical issues to deal with. The Board moved to recommend approval of the project's request for FY99 funding with requirements that SERDP and the Principal Investigator develop definitive language of what will be provided in the design of the guidance package to ensure effective technology transfer. In the absence of a quorum, the vote was 5-0 for approval of the motion. (This vote was later ratified via telefax by a vote of 9-0-1 for the recommendation for FY99 funding, with one Board member abstaining.)

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**Title:**

CU-1129: Biological Assessment for Characterizing Contaminant Risk at the Genetic-, Individual-, and Population-Levels

**Performer:**

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

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***Requested Funding:***

\$514K (FY99 New Start)

***Summary:***

The project's technical objectives are to: (1) develop "effects-based assays" which account for contaminant bioavailability and toxicity of complex contaminant mixtures; (2) generate dose-response information for military-relevant contaminants by measuring responses in molecular biomarkers and whole organisms; and (3) develop population models to project contaminant exposure impacts on the ecosystem population level.

***Recommendation:***

(September) Voicing support of the project, Board members opined that the project is high risk, but also has sufficient understanding to proceed. Board members stressed the apparent great potential for high payoff, and noted that stress responses can be discovered with the use of molecular techniques. Board members stated that this project is a good sister project to the ongoing SERDP-funded Genosensor project (CU-1081) and that it might be the precursor to a whole new cleanup area. The Board opined that the Principal Investigator (PI) is seeking a surrogate that assists in reducing the "noise" in order to better develop ecological risk assessment techniques, that the burden for the PI is to determine the ecological significance of the project, and specifically how the proposed molecular techniques will yield credible data. Board members were curious about what specifically will be done to increase the state-of-the-art that will lead to an increased ecological significance. Board members questioned the degree of focus on ecological processes and expressed the expectation that the scientific peer review process will ensure that the data from the project are properly interpreted. The Board moved to recommend approval of the project's request for FY99 funding. In the absence of a quorum, the vote was 4-1 for approval of the motion, with one Board member casting the negative vote. (This vote was later ratified via telefax by a vote of 8-1-1 for the recommendation for FY99 funding, with one Board member abstaining.)

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***Title:***

National Environmental Technology Test Sites (NETTS) Program

***Performer:***

U.S. Navy/U.S. Air Force/Environmental Protection Agency (EPA)

***Requested Funding:***

\$2,190K (FY99 Continuing Project)

***Summary:***

The current process for gaining acceptance of cost-effective innovative technologies for the cleanup of federal installations is laborious and costly. The problem stems from several causes, including the lack of formally established technology demonstration programs ensuring protocols and quality assurance/quality control procedures sufficient to meet requirements of regulators, users, and information dissemination in formats suitable for all interested parties. These causes can be addressed by a comprehensive technology

demonstration/evaluation/transfer program. This continuing grouping of projects provides such a comprehensive technology demonstration/evaluation transfer program. The goal is to provide locations for comparative demonstration and evaluation of cost-effective and innovative technologies to enable transfers from research to full-scale use. The Test Sites Program provides different demonstration locations in a wide variety of geologic and contaminant settings, all fully characterized. These sites include a fuel hydrocarbon site located at Port Hueneme, California, an organic contaminants site located at the former Wurtsmith Air Force Base in Michigan, a solvents test site located at McClellan Air Force Base in California, and a controlled release site at Dover Air Force Base in Delaware. This year included SERDP Program Office's decision to discontinue funding of the energetics test site, located at Volunteer Army Ammunition Plant in Tennessee, based on insufficient demand for this test location and previous recommendations from the SAB and the Comprehensive Review Committee.

***Recommendation:***

(June) Board members raised a question concerning the development and utilization of the NETTS database. This question led to a discussion among Board members regarding the level of utilization of the NETTS locations for demonstrations and the utility in having SERDP maintain a record of past and current demonstrations performed at NETTS locations. Consequently, the Board requested that SERDP Staff provide the SAB with a comprehensive list of past, present, and future demonstrations at each test site and a listing of open literature publications associated with technology demonstrations at these sites. Noting that three years had past since the FY96 Comprehensive Review of the NETTS program, Board members also opined that the NETTS Program would benefit from another such review in FY99, stating that such a forum would bring into focus the past performance and the future plans. The Board motioned to recommend approval of the FY99 funding for the NETTS Program with the condition that SERDP conduct another comprehensive review of the NETTS Program in FY99 since the program was approaching three years from the conclusion of last review that was held in June 1996. Board members suggested including some newly elected SAB members to serve on the review panel to ensure continued input and oversight to the NETTS Program over the next few years. A second was offered and the motion was approved by a vote of 10-0.

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## Compliance Thrust Area

***Title:***

CP-819: National Environmental Education and Training Center (NEETC) Earmark

***Performer:***

National Environmental Education and Training Center (NEETC)

***Requested Funding:***

\$1,500K (FY98 Earmark)



**Summary:**

Funded by SERDP as a result of an FY94 earmark, this project was earmarked for an additional \$1,500K by Congress for FY98 to continue pursuing its technical objectives, which are to: (1) develop a knowledge-based expert system prototype (TECHXPERT) that will evaluate and incorporate worker environmental safety and health issues in technology design; (2) implement TECHXPERT on the World Wide Web; and (3) develop informational models to facilitate local community understanding of perceived or real hazardous waste/pollution prevention issues and acceptance of novel environmental technologies.

**Recommendation:**

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(June) Board members opined that, despite any scientific merit that may be present within the scope of the project, the earmark project does not apply to SERDP's scientific goals or support SERDP's mission. This sentiment was supported by the other Board members present. With consideration of the concerns voiced by Board members, the Board moved to disapprove this project as part of SERDP Program. The motion against approval was seconded and was carried by a vote of 8-0.

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**Title:**

CP-1060: Laser-Based Spectrometers for Air Emissions Monitoring

**Performer:**

Sandia National Laboratory

**Requested Funding:**

\$1,040K (FY98 Continuing Project)

\$910K (FY99 Continuing Project)

**Summary:**

The technical objective of this project is to develop and demonstrate compact, highly sensitive laser-based spectrometers for toxic metal and organic emissions monitoring. The approach incorporates a novel, solid state laser technology, a periodically poled lithium niobate (PPLN), and a compact, portable laser induced breakdown spectroscopy spectrometer for real time, in-situ monitoring of toxic metals emissions. This effort seeks to develop a near real time, in-situ monitoring of a wide range of species (metals and gases) with high sensitivity and performance. The proposed system will be a cost-effective monitor that will save the Department of Defense and the Department of Energy millions of dollars in chemical analyses.

**Recommendation:**

(March) Board members raised questions regarding the detection sensitivity of the technology being developed under the scope of the project. Related to low source concentrations of contaminant emissions, the Board asked whether the technology had any application in ambient conditions. Board members asked about possible applications for the air emissions monitoring technology, including whether stack monitoring was a suitable application. Board members inquired whether: (1) any user interface had been established; (2) any test incinerators had been identified; and (3) any stack sampling expertise was on the project team.

The Board moved to recommend approval of the project's request for FY99 funding, and this motion was approved by a vote of 10-0.

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***Title:***

CP-1078: Enzymes for Degradation of Energetic Materials and Demilitarization of Explosives Stockpiles

***Performer:***

Pacific Northwest National Laboratory

***Requested Funding:***

\$300K (FY99 Continuing Project)

***Summary:***

The objective of this project is to develop an enzyme-based technology that can efficiently, safely, and economically render energetic materials non-hazardous. The approach involves the transformation of munitions (e.g., trinitrotoluene (TNT), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and octahydro-1,3,5,7-tetranitro-1,3,5,7-tatrazocine (HMX)) to intermediate (non-hazardous) products using enzymes. It is a free-radical-based process where enzymes are the source of free radical generators. If successful, this technology offers a low-cost, flexible process to eliminate the hazard of energetic material stockpiles.

***Recommendation:***

(June) Raising questions regarding the technical approach of the project and some possible limitations, Board members asked about the ratio of enzyme present to TNT molecules and about the relative loading of the enzymes, specifically inquiring as to the amount they could handle and at what rate. The Board also cited the well-documented biotransformation of energetics material and the expected production of toxic end-products. Board members asked about the existence of any go/no-go decision point in FY99 and decision metrics that would impact continuation of the project. The Board moved to recommend approval for FY99 funding, and the motion was seconded. Discussion of the motion included suggestions to have SERDP staff: (1) closely monitor the project as it progresses regarding the following issues: (a) the high risk nature of the research to produce the expected results in a real world setting, (b) the true effectiveness of performing the enzyme step and biological treatment step in sequence, and (c) the toxicity of TNT metabolites that would be produced by a pure enzyme reaction as compared to those produced in the previous composting research performed at Umatilla; and (2) report to the SAB on the project's progress after the FY99 In-Progress Review. The motion including the recommendations was seconded and approved by a vote of 10-0.

***Title:***

CP-1079: Hypergolic Non-Detonative Neutralization in Production and Demilitarization Followed by Steam Reforming and Flameless Oxidation

***Performer:***

Sandia National Laboratory

***Requested Funding:***

\$450K (FY99 Continuing Project)

***Summary:***

The objective of this project is to develop a two-step system for high-throughput, cost-effective, and environmentally conscious disposal of energetic materials (production wastes or assembled munitions). The proposed process consists of: (1) reacting the energetic materials with a hypergolic chemical, which neutralizes the energetic materials while precluding a detonation; and (2) analyzing the neutralized organic residues for possible reuse applications or effective safe disposal. Two strategies will be applied, one using relatively low temperature-controlled exothermic reactions in a liquid phase environment, and another using solid state controlled hyperbolic reactions.

***Recommendation:***

(June) Voicing concerns regarding the analysis of reaction end-products, Board members noted the lack of clarity provided in the briefing regarding the timing and nature of any explicit research devoted to the proposed reuse of neutralized organic residues that would be the byproducts of the neutralizing reactions. Expanding on these concerns, the Board questioned the apparent lack of any characterization of the waste streams, citing that the researchers may have oversimplified the possible reaction pathways. Further discussion among Board members raised questions regarding the investigation into the supplementary biodegradation of surplus munitions, as well as the relative scalability of the proposed process and the impact on the rates of reaction. With consideration of these concerns, the Board moved to recommend approval for FY99 funding. Once seconded, the motion was approved by a vote of 10-0.

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***Title:***

CP-1105: Membrane-Mediated Extraction and Biotreatment of Volatile Organic Compounds (VOCs)

***Performer:***

Environmental Protection Agency (EPA)

***Requested Funding:***

\$570K (FY99 Continuing Project)

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**Summary:**

The project's technical objective is to develop a novel membrane biotreatment (MBT) system that combines a first-stage microporous hollow-fiber membrane unit to extract and concentrate VOC contaminants into a low-volatility organic stripping fluid, with a similar second-stage membrane unit in which the VOCs are extracted into a nutrient medium for biotreatment. The technology is being developed to treat fugitive VOC contaminant release during application or removal of aircraft coatings. Optimization of the process will accommodate intermilitary painting operations and reduce equipment size.

**Recommendation:**

(September) The Board inquired about the magnitude of the apparent partition coefficients of methyl ethyl ketone (MEK) and toluene derived from the proof-of-concept evaluation and expressed an additional concern that implementation of the technology may not be practical given the membrane size that might be required to achieve acceptable mass transfer rates. Board members questioned the disposition of the biotreatment unit after the project is completed at Tyndall Air Force Base. The Board opined that they were very uncomfortable with the project, suggesting that funding the second year is premature until the data claims that the process will work for the mass transfer and flux rates. Board members suggested that SERDP staff look at this project very critically during the next In-Progress Review in FY99. The Board moved to recommend approval of the project's request for FY99 funding. In the absence of a quorum, the vote was 5-0 for approval of the motion as modified. (This vote was later ratified via telefax by a vote of 8-1-1 for the recommendation for FY99 funding, with one Board member casting the negative vote, and one Board member abstaining.)

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**Title:**

CP-1106: Characterization of Particulate Emission: Size Characterization and Chemical Speciation

**Performer:**

University of Utah

**Requested Funding:**

\$989K (FY99 Continuing Project)

**Summary:**

The objectives of this project is to develop advanced methods for measuring the size distribution and composition of particulate matter emitted from mobile and stationary sources. The project's technical approach involves using: (1) a portable dilution sampler for use with aerosol instruments; (2) an aerosol time-of-flight mass spectrometer for positive and negative ion detection; (3) a photoelectric detector for rapid, composite measurement of polycyclic aromatic hydrocarbons (PAH) prevalent components of particulate matter; (4) micro-orifice impactors to obtain size-segregated particles for chemical analysis; and (5) standard chemical analysis of filter samples for targeted toxic constituents. The cost effectiveness of different measuring methods will be assessed, and recommendations will be made for the best protocols for measuring fine particle emissions.

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***Recommendation:***

(September) The Board opined that this technology is an excellent method to fingerprint vehicles and assess emission producing equipment. Some Board members wanted assurance that the project had addressed the concern of the Board from the last review, specifically issues regarding lack of leveraging of industrial partners and the user community, and if the Technical Advisory Committee (TAC) was convened per the SAB's request. The Board was concerned that the project may not be able to retrieve real time data for moving vehicles and that there could be a possible overload of data within the project. Board members inquired if there was an interim report for the project that shows data for the speciation of the compounds. The Board moved to recommend approval of the project's request for FY99 funding. A second was offered and the motion was approved by a vote of 6-0.

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***Title:***

CP-1108: Novel Nonporous Fouling-Resistant Composite Nanofiltration Membranes and Membrane Separation Systems for Wastewater Treatment

***Performer:***

North Carolina State University

***Requested Funding:***

\$411K (FY98 New Start)

***Summary:***

This project is developing a novel type of fouling-resistant composite membrane module for shipboard wastewater treatment systems. The composite membrane is a highly water permeable, nonporous, block copolymer layer supported by a microporous membrane. A systematic series of phase-separated block copolymers will be synthesized and characterized. The best membrane materials will be selected for both bench and industrial scale systems.

***Recommendation:***

(October) The Board raised several concerns regarding the intended measurements of performance within the project. Citing the benefits of a clear mass balance, Board members opined that gaining insight within the scope of this project regarding the actual volume and characteristics of the reject water would be useful to provide to the next group responsible for treating the reject water. The Board moved to approve the project's request for FY98 funding, and the motion was approved by a vote of 7-0 with one Board member abstaining.

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**Title:**

CP-1120: Development of a Catalyzed Ceramic Filter for Combined Particulate Matter 2.5 (PM2.5) Removal and Volatile Organic Compound (VOC) and Carbon Monoxide (CO) Oxidation

**Performer:**

CeraMem Corporation

**Requested Funding:**

\$262K (FY99 New Start)

**Summary:**

This project is developing a membrane coating using a novel metal VOC/CO oxidation catalyst for a high performance ceramic filter to control pollutant emissions from combustion gas sources. Membrane and catalyst formulations and deposition procedures will be optimized to prepare a prototype filter to full-size application.

**Recommendation:**

(August) The Board raised questions whether there had been any testing of the membrane filter. Board members strongly encouraged the benefit of coordinating with other membrane separation technologies, specifically mentioning future declassified work at Department of Energy Oak Ridge operations that was based on gas diffusion activities. Board members specifically questioned the lack of data to support the projected applications and the use of sodium chloride (NaCl) as a test aerosol due to its volatility and potential to react with certain ceramics at high temperatures. Some Board members opined that the project appeared to be a fishing expedition, while others considered the project an opportunity. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding for the project, and the motion was approved by a vote of 5-0. This vote was later ratified in the presence of a quorum by a vote of 7-0.

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**Title:**

CP-1126: Reduction of Particulate Emissions from Jet Engine Test Cells Using an Annular After-Reactor

**Performer:**

Naval Facilities Engineering Services Center

**Requested Funding:**

\$259K (FY99 New Start)

**Summary:**

This project is developing a prototype annular after-reactor (AAR) jet engine attachment to control particulate matter 2.5 (PM2.5) emissions from jet engine test cells (JETC). The AAR is a hollow pipe that

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delays the mixing of exhaust gases with the air stream long enough to permit incineration of the PM (up to 90%) with little drop in pressure. With slight modification, the system may also be adapted for removal of nitrogen oxide (NO<sub>x</sub>), carbon monoxide (CO), and unburned hydrocarbons. Comprehensive analytical and computer modeling efforts will address the hot engine exhaust flows through and around the AAR, the effects of those flows on overall JETC pressure drop, mixing effects, its ignition and heating of the flow, the chemical kinetics, and the effects of changes in shape and position of the AAR.

***Recommendation:***

(August) Board members raised some general issues with the proposed technology, including concerns regarding production of NO<sub>x</sub> in the reaction stream. Board members also voiced concerns regarding the complex mixing requirements that may be difficult to achieve. Board members questioned the apparent absence of Air Force involvement in the project and requested Air Force involvement in the early stages of the project, as well as better defining the commitment from the Navy within the scope of the project. The Board also questioned the appropriateness of any full-scale testing with SERDP funding. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding for the project, and the motion was approved by a vote of 5-0. This vote was later ratified in the presence of a quorum by a vote of 7-0.

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***Title:***

CP-1132: Thermal, Actively Controlled Sludge Treatment

***Performer:***

Naval Air Warfare Center Weapons Division

***Requested Funding:***

\$500K (FY99 New Start)

***Summary:***

This project is developing a highly compact, high-performance, two-stage incineration process consisting of: (1) a primary vortex containment combustion (VCC) process, which separates and retains particulates; (2) a self-propagating, high-temperature synthesis (SHS) thermal processing and encapsulation process for treatment of resultant ash; and (3) an actively controlled and monitored afterburner process for emissions reduction. The process will be automated and integrated into a comprehensive, continuously operated, oily water treatment system to remove oil from a variety of aqueous waste streams prior to discharge.

***Recommendation:***

(September) The Board opined that the project has not adequately addressed the concerns of the peer reviewers, that this project is high cost and high risk, and that there is an apparent lack of understanding by the Principal Investigator (PI) of the fundamentals of sludge thermal processes. Other Board members were concerned that not all of the safety issues have been considered, citing that oil and water mixtures within the waste stream can change dramatically over short periods and could pose a threat to users if not controlled. The Board moved to table the project and any action on the project's request for FY99 funding.

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The Board suggested that the project return to a future SAB meeting and adequately explain the state-of-the-art of the project to the Board and specifically address the reviewers comments. Board members supported the notion that SERDP projects should take risks, but at the same time the Board needs to limit the risks. A second was offered, and the motion to table was approved by a vote of 4-1-1, with one Board member casting the negative vote and one Board member abstaining.

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***Title:***

CP-1136: Purification of Oily Wastewaters by a One-Step, Advanced Biodegradation Process that Produces No Secondary Wastestreams

***Performer:***

Foster-Miller Inc.

***Requested Funding:***

\$481K (FY99 New Start)

***Summary:***

The project's technical objective is to develop a one-step, low-maintenance biotreatment process to efficiently destroy organic wastes without producing any sludge. It overcomes the traditional slow-throughput and sensitivity drawbacks of biological processes by applying a new genetic-enhancement technique for microorganism cultures called forced molecular evolution. This technique provides customized, microbial isolates targeted toward oily waste components in bilgewater.

***Recommendation:***

(September) Board members expressed concern that the project had not completed any preliminary testing on bilgewater and that the use of bioreactor technology is not currently being employed by the PI. The Board raised several concerns regarding the forced molecular evolution process. The Board explained that much of the wastestream is not a single compound, and these multicomponents are often resistant to biodegradation due to their branched and complex ring structures, high-molecular weights, emulsification processes, and hydrophobic characteristics. The Board also expressed concern that satisfying the biological oxygen demand (BOD) within the system will be a significant problem; the mechanical energy required to sustain the BOD would provide an unfavorable environment for the organisms; and the organisms will not be able to produce high degradation of the contaminants with a short residence time. The project did not adequately state how the biomass and oils from the organisms (10% of mass) would be filtered and disposed of, nor did it explain how the nutrients for the organisms would be provided to the bioreactor to degrade variable substrates. The Board opined that the project is very high risk and that not all of the problems have been thought out, emphasizing that bilgewater can change dramatically in composition over a short amount of time and that the PI needs to address how they plan to keep a suite of organisms alive in a drastically changing environment. Board members opined that production and toxicity evaluation of solids is still a question that needs to be addressed. The Board recommended that the SAB take no action on this project and have the project come back at a future SAB meeting to address the issues raised. A second was offered, and the motion to table was approved by a vote of 4-2, with two Board members casting the negative votes.

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## Conservation Thrust Area

***Title:***

CS-1054: Development and Demonstration of a Risk Assessment Framework for Natural Resources on Military Training and Testing Lands

***Performer:***

Oak Ridge National Laboratory

***Requested Funding:***

\$600K (FY99 Continuing Project)

***Summary:***

The goal of this project is to develop a consistent, defensible, and easily implemented framework for assessing risks to natural and cultural resources from military testing and training missions, thus maintaining required levels of readiness. This framework would incorporate physical, chemical, and biological stressors, including noise, and their direct and indirect effects, short- and long-term, on natural and cultural resources.

***Recommendation:***

(March) The Board raised questions about the eventual implementation of the completed product of the research. Opining that the proposed risk assessment tool did not seem simple to implement, Board members inquired regarding any plans to provide hands-on training for potential users of the completed risk assessment framework. Raising issues related to the effective implementation of the framework once it is developed, Board members cited an apparent weakness in the integration of existing data for the intended processing within the framework, as evidenced by the limited list of risk assessment end points and the difficulties in calculating effects coefficients. Similar concerns were voiced by Board members, who cautioned that dose response curves do not exist for many of the factors intended for incorporation into the framework, and stressed the risk that the Department of Defense (DoD) or other groups will not fully support the data collection and modification necessary for incorporation into the framework. With certain Board members citing the project as a piece of a more strategic task and stating that it represented activity that DoD must address, the Board made a motion to recommend approval of the project for FY99 funding. The motion was approved by a vote of 7-0.

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***Title:***

CS-1082: Information and Technology Tools for Assessment and Prediction of the Potential Effects of Military Noise on Marine Mammals

***Performer:***

Naval Command, Control and Ocean Surveillance Center

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***Requested Funding:***

\$370K (FY99 Continuing Project)

***Summary:***

The objective of this project is to: (1) study and compare the evidence for normal versus pathological changes of marine mammal ear anatomy; (2) utilize state-of-the-art knowledge about baleen whale ears to motivate a computational model of baleen whale hearing ability; and (3) develop a statistical approach that will help identify whale "hot spots," including seasonal and/or geographic peaks in whale density, and/or migratory corridors.

***Recommendation:***

(June) Board members raised questions regarding the number and composition of the samples being investigated under the project, specifically citing reliance on the serendipitous beaching of marine mammals to supply adequate subjects for analysis as a project vulnerability. The Board raised questions regarding the actual benefit to the Navy and how this area of research complemented the other marine mammal impact programs. The Board moved to recommend approval the project contingent on the project's continuing to coordinate with the other SERDP ongoing marine mammal related projects (CS-48 and CS-1069). Additional requirements included: (1) a provision to support FY99 funding contingent upon demonstrated interest from the Navy to assume eventual ownership of the project; and (2) a requirement to document, in annual reports, any useful findings of project and provide them to the SAB. The motion, with the requirements, was approved by a vote of 11-0.

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***Title:***

CS-1088: Land Management Systems (LMS)

***Performer:***

U.S. Army Corps of Engineers Waterways Experiment Station (WES)

***Requested Funding:***

Informational Only

***Summary:***

This brief presented an overview of the jointly-funded SERDP/Army effort. The objective of this overarching effort is to define the status of landscape and ecosystem management modeling and simulation (M&S) in terms of data, data management, models, modeling theory, and technology. A second objective is to support the identification of a course for future investments, both by SERDP and other services, activities, and agencies. The LMS approach associated with data, modeling, and simulation involves the following tasks: (1) examining the various protocols for modeling and simulation data; (2) developing a land management M&S catalog or compendium of efforts, technologies, and techniques that will support integrated land management M&S; (3) determining the strengths and weaknesses of existing M&S efforts and what strengths need to be exploited and weaknesses addressed to ensure an integrated future for land

management decision support; (4) developing a design and structure for future land management M&S capability; and (5) identifying and developing the M&S linkages needed to ensure effective land management decision support capabilities in the future.

***Recommendation:***

(January) Board members inquired regarding the likelihood of acceptance by regulators of the data management, modeling, and simulation activities being pursued under the LMS effort. Concerns were raised regarding the uncertainty of the successful integration of modeling and simulation achieved so far under the LMS effort. Additionally, certain members expressed skepticism regarding the achievement of future successes. Identifying an apparent LMS programmatic weakness, a Board member opined that the program needed a clear user-level advocate. Some Board members supported this view while voicing reservations regarding the credibility of the LMS when applied on a larger scale. Noting that the LMS could serve a useful purpose at the base level, Board members suggested that the program would benefit from an increased focus on customer development for the products of the LMS. The SERDP portion of this project was completed in FY98. Consequently no action was taken by the Board.

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***Title:***

CS-1096: Error and Uncertainty Analysis for Ecological Modeling and Simulation

***Performer:***

U.S. Army Construction Engineering Research Laboratory (CERL)

***Requested Funding:***

\$575K (FY98 New Start)

***Summary:***

The project's technical objectives are to provide: (1) the rationale to account for the effects of different sources of error on the uncertainty of predictions made through models; and (2) the rationale/methodology to efficiently assess where additional resources should be added to reduce areas of uncertainty that most impact the ability to accurately predict an outcome. The proposed analytical framework would be made available as a user-friendly interactive software package and provide model users with the means to assess and exert control over the quality of the simulation results. The project would also apply this methodology to a monitoring-modeling system employed by the military for assessment and/or management of natural and cultural resources at one military installation. Two primary candidate models are the Army Training and Testing Area Carrying Capacity (ATTACC) model and/or the Terrain Modeling and Soil Erosion Simulation. This capability will, in turn, provide the necessary quality control/assurance mechanisms to support decision-making regarding natural and cultural resources.

***Recommendation:***

(October) The Board raised questions on the uniqueness of the proposed uncertainty analysis. Noting the apparent similarities to economic and other models, Board members suggested that the proposed conservation error analysis model could have more of an environmental focus. When assured that the

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project would provide a "tool kit" to work across general models, Board members expressed reservations about the generic approach of the uncertainty analysis and opined that the focus may be too generic. With consideration of the concerns voiced, the Board moved to approve FY98 funding for the project with the requirements for SERDP staff to: (1) obtain a more detailed management plan; (2) carefully review projected costs; (3) obtain a plan for involving local expertise in the conduct of the case study; and (4) review and assess the project's performance at the end of the first year and report to the SAB on a go/no-go decision. In the absence of a quorum, the motion was seconded and approved by a vote of 7-0, including a proxy left by one Board member. This vote was later ratified via telefax by a vote of 10-1 for the recommendation for FY98 funding, with one Board member abstaining.

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***Title:***

CS-1098: Emerging and Contemporary Technologies in Remote Sensing for Ecosystem Assessment and Change Detection on Military Reservations

***Performer:***

U.S. Army Topographical Engineering Center

***Requested Funding:***

\$1,000K (FY98 New Start)

\$1,050K (FY99 Continuing Project)

***Summary:***

The project's technical objectives are to: (1) stratify the landscapes of individual military ranges using contemporary and emerging remote sensing technologies; (2) identify the fundamental vegetation and soil attributes of military ranges as they relate to plant succession; (3) establish ecosystem response and recovery in relation to disturbance (land use) through retrospective studies with spatially explicit spectral-based indices; (4) identify the spatial, spectral, and temporal attributes of remote sensing systems necessary to identify ecotones, and to distinguish environmental and disturbance gradients; and (5) develop methods for scaling indices between coarse and fine resolution imagery.

***Recommendation:***

(January) The Board raised questions about landscape detection boundaries as discussed in the project briefing. Board members inquired regarding the presenter's knowledge of and exposure to the state of the art in statistical boundary detection research for detection and delineation of significant ecological changes or impacts. Conceding the ability of the researchers to remotely detect changes in vegetation at a given site, Board members questioned the ability of the researchers to adequately and accurately attribute these changes to certain causes. Stating the need to ensure adequate integration of the diverse project team, the Board suggested additional coordination with an outside group, specifically the Environmental Monitoring and Assessment Program (EMAP), which focuses on investigating biodiversity issues. With consideration of the concerns raised, the Board moved to approve the project and included amendments that require the project to: (1) pursue closer interaction with the EMAP and address the coordination results in the FY99 briefing; and (2) provide to the Board a written plan of implementation that outlines the coordination of

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the project team with the EMAP. The motion with the two requirements was approved by a vote of 9-0, with two Board members abstaining.

(June) Questioning limitations in the implementation of the project, Board members voiced a concern regarding the recurring annual need to fly over sites to collect the remote sensing data. Citing the additional requirement for trained personnel to interpret the data collected and to perform the followup ground-truthing, the Board cautioned that the proposed research seemed costly and limited. Board members voiced the need to closely coordinate the remote sensing activities and the in-situ monitoring efforts to ensure a feedback loop of information between the two groups, stressing the importance of capitalizing on data collected by the EMAP, as well as providing information that would enhance the activities performed by the EMAP. The Board moved to recommend approval of the project's request for FY99 funding providing that the SAB-recommended coordination with the EMAP is implemented. Based on concerns voiced by Board members regarding the proposed retrospective analysis aspect of the project and its value added to the research, the Board added amendments that would require: (1) SERDP to track and assess the benefit of the retrospective analysis; and (2) the principal investigator (PI) to add a project deliverable in FY99 or FY00 for a detailed plan of how individual Department of Defense sites would use and implement this program. The motion, with requirements, was approved by a vote of 11-0.

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***Title:***

CS-1130: Dynamic Modeling of Military Training Impacts and Archaeological Site Distributions in Evolving Landscapes

***Performer:***

U.S. Army Construction Engineering Research Laboratory (CERL)

***Requested Funding:***

\$490K (FY99 New Start)

***Summary:***

The project's technical objectives are to develop a tool to better determine the likelihood of cultural artifacts to exist on military lands. It takes advantage of novel advancements made in predictive archaeological modeling, geomorphic process modeling, and probability modeling of the impacts of military training. This suite of models will provide a quantifiable, scientifically based judgement of risk and can be readily implemented by incorporation into existing decision support systems for training, cultural, and natural resource management.

***Recommendation:***

(September) Board members expressed that the project had very limited value-added, citing that 2-D modeling works very well and that 3-D is not necessary. Board members were concerned that the technical approach defined for validation of the proposed technology was problematic, citing that the model is limited, since digging and sampling were required even after the model was applied. The Board expressed concern that there may not be any value in considering depths in excess of one meter and that the modeling would not quantify uncertainties. Some Board members opined that certain training areas could benefit

from 3-D modeling and that this technology could help to prioritize land that is being used at military bases. Board members expressed that the technology will help the end-user address the question of "what if" analyses. The Board moved to recommend approval of the project's request for FY99 funding. A second was offered and the motion was discussed by the Board members. Some Board members again expressed that the use of 3-D may be unnecessary since 2-D has proven to be a good model. Some Board members opined that certain training areas could benefit from 3-D modeling. The motion was approved by a vote of 3-2. (Later, in the presence of a quorum, the Board voted 3-3 and failed to ratify their earlier recommendation of approval for FY99 funding. The Board suggested that the issues raised by the SAB should be provided to the PI to address and have the project rebrief the Board at a future meeting.)

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***Title:***

CS-1131: Diagnostic Tools and Reclamation Technologies for Mitigating Impacts of Department of Defense (DoD)/Department of Energy (DOE) Activities in Arid Areas

***Performer:***

Bechtel Nevada

***Requested Funding:***

\$545K (FY99 New Start)

***Summary:***

The project's technical objectives are to develop and evaluate innovative and cost-effective image collection and processing techniques to provide rapid assessment of training impacts to desert ecosystems. It also proposes to provide restoration/revegetation techniques to rapidly assess site potential for resiliency/recovery from training exercises. These diagnostic and restoration tools will be applicable to military training and testing in other desert ranges as well as non-desert ranges and will facilitate models currently in use or in development. Citing his affiliation with Bechtel, a Board member recused himself from the discussion and indicated that he would abstain from voting.

***Recommendation:***

(September) The Board expressed concern regarding the apparent emphasis on diagnostic versus reclamation, as well as a lack of peer-reviewed publications within the project's team. Board members questioned if the proposed technology would alter the ecosystem, specifically replanting vegetation and watering. Regarding other DoD facilities, Board members questioned if the technology could be used in other environments. The Board opined that the project should use future advancements in satellite imagery to assist in assessing when the ecosystem is back to a baseline. The Board moved to recommend approval of the project's request for FY99 funding. A second was offered and the motion was approved by a vote of 4-0-1, with one Board member abstaining. (This vote was later ratified in the presence of a quorum by a vote of 5-0-1, with one Board member abstaining, to ratify their earlier recommendation of approval for FY99 funding.)

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## Pollution Prevention Thrust Area

***Title:***

PP-867: Solventless Manufacture of Artillery Propellant Using Thermoplastic Elastomer (TPE) Binder

***Performer:***

Naval Air Warfare Center/Weapons Division

***Requested Funding:***

\$300K (FY99 Continuing Project)

***Summary:***

The objective of this project is to demonstrate the feasibility of reducing or eliminating the emission of volatile organic compounds (VOCs) associated with the production of multibase gun propellants by using thermoplastic elastomer (TPE) propellants. Artillery propellant production currently creates up to 2.5 tons/day of VOC emissions, based on an annual production rate of 5.5 million pounds/day of triple-based propellants. New propellant formulations that reduce or eliminate the use of solvents will be developed and evaluated for the replacement of current propellants that require solvents to manufacture. After down-selecting to one or two formulations, manufacturability, safety, sensitivity, and performance characteristics will be evaluated in "proof of principal" tests.

***Recommendation:***

(March) The Board raised several concerns regarding the true goals of the project and the environmental aspects of the research. Questioning the apparent material development objective of the project, Board members cautioned that the majority of the effort relied on the benefits of the innovative manufacturing process, and noted that uncertainties remained regarding the success of the twin-screw extrusion process. The Board moved to recommend approval of the project's request for FY99 funding, and the motion was approved by a vote of 9-0.

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***Title:***

PP-1056: Low Volatile Organic Compound (VOC) Chemical Agent Resistant Coating (CARC)

***Performer:***

U.S. Army Armaments Research, Development, and Engineering Center (ARDEC)

***Requested Funding:***

\$950K (FY99 Continuing Project)

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**Summary:**

The technical objective of this project is to develop a low VOC CARC suitable for use on military equipment by all services, in which the materials and processes for the reformulation/application, stripping and disposal are optimized and in compliance with current and anticipated regulatory requirements. The research will be performed primarily in two focus areas: (1) reformulation/application, and (2) stripping and disposal. The primary deficiency in the current CARC is the excessive VOC level of the polyurethane topcoat. At current production levels, 10.4 million lbs/year of VOCs are emitted to the atmosphere from CARC painting operations. The existing CARC topcoat has a VOC content of 3.5 lbs/gal, while the local regulations are 2.8 lbs/gal in the San Diego Air Quality Management District. Moreover, some installations must limit VOC contents to 1.8 lbs/gal in order to meet total VOC emission limits imposed by regulatory agencies. At the current annual nationwide usage rate, estimated to be 3.0 million gallons per year, a CARC with a VOC content of 1.8 lbs/gal would reduce VOC emissions during the applications by at least 5 million pounds proportionately reducing photochemical smog, and avert Notices of Violations at various DoD facilities. In addition to addressing the VOC problem, a secondary objective of this project will be to eliminate hazardous air pollutants (HAPs) and toxic solvents used in current formulations.

**Recommendation:**

(March) Board members raised concerns regarding current VOC limitations that serve as the primary environmental goals for the project. A general discussion included the drive to reach the current limits and the impact and possibility of the imposition of a zero VOC emission requirement in the future. Following a short discussion of the actual patented chemical process, the Board moved to recommend approval of the project's request for FY99 funding. The motion was seconded and approved by a vote of 9-0.

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**Title:**

PP-1058: Elimination of Toxic Materials and Solvents from Solid Propellant Components

**Performer:**

U.S. Army Aviation and Missile Command

**Requested Funding:**

\$1,330K (FY99 Continuing Project)

**Summary:**

The objective of this project is to eliminate major sources of toxic/hazardous materials used in missile systems. This will be accomplished by implementing pollution prevention research in the following two areas: (1) green energetics: (a) eliminate lead as a ballistic catalyst in minimum signature propellants and (b) eliminate hydrogen chloride as a combustion product of tactical and strategic booster propellants; and (2) clean energetic processing: develop energetic oxidizer processing methods that do not require volatile organic compounds and toxic materials.



***Recommendation:***

(March) Conceding the value in the objectives of the project, Board members questioned the lack of any clear evaluation of the environmental tradeoffs related to substitution materials, specifically questioning whether the researchers had adequately considered the environmental impact from the substituted bismuth as compared to the existing adverse impact from lead. Board members strongly advocated that the researchers ensure the performance of a sound evaluation process, emphasizing the need for a quantitative, rigorous evaluation between the candidate substitution materials and those being replaced. These concerns were formalized in the suggestion that SERDP Program Manager for Pollution Prevention address the SAB concerning the extent to which the environmental impact of product substitution is assessed as an integral part of Pollution Prevention projects, with particular emphasis on investigating: (1) whether any such requirement exists for each project; (2) whether any common methodology is in use; and (3) how are results transmitted. The Board moved to recommend approval of FY99 funding with the requirement for the project to: (1) develop a progressive plan to quantitatively assess the environmental impacts of production substitution (e.g., replacement of lead with bismuth); (2) present this plan to the Board as part of next year's briefing; and (3) ensure that the individual from the Environmental Protection Agency responsible for performing the risk assessment be present at the briefing in FY99. The motion, with the requirements, was approved by a vote of 9-0.

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***Title:***

PP-1059: Next Generation Fire Suppression Technology Program (NGFSTP)

***Performer:***

National Institute of Standards and Technology

***Requested Funding:***

\$3,500K (FY99 Continuing Project)

***Summary:***

The goal of this program is to develop and demonstrate, by 2004, environmentally friendly and user-safe processes, techniques, and fluids that meet the operational requirements satisfied by halon 1301 fire suppression systems in aircraft, ships, land combat vehicles, and critical mission support facilities. The results will be specifically applicable to field weapon systems, and will provide dual-use fire suppression technologies for preserving both life and operational assets. The program is divided into the following six fully integrated technical thrusts, each with sequential and synergistic research elements: (1) risk assessment and selection methodology; (2) fire suppression principles; (3) technology testing methodologies; (4) new suppression concepts; (5) emerging technology advancement; and (6) suppression optimization. In all, the NGFSTP framework consists of 32 research elements. The research activities within the 32 elements have begun identifying and developing fire suppression technologies, and additional knowledge will be added continually throughout the program.

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***Recommendation:***

(August) Board members expressed concern that even though the accomplishments of the first two years look significant, very few peer-reviewed publications have been produced thus far. Concerns were voiced that \$5 million has been expended for this effort, yet only two peer-reviewed publications have resulted. Board members expressed concern that the leveraged funding from various Services as planned in the program has not materialized (specifically FY98). They questioned the Services view of the need to address the alternatives to halon 1301 issues as a high priority. With respect to concerns raised regarding the lack of journal publications, the Board moved to recommend approval of the project's request for FY99 funding. In the absence of a quorum, the motion, with the requirements that the publication record in the peer-reviewed journals be markedly improved, was approved by a vote of 5-0. This vote was later ratified in the presence of a quorum by a vote of 7-0.

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***Title:***

PP-1109: Non-Polluting Composites Repair and Remanufacturing for Military Applications

***Performer:***

U.S. Army Research Laboratory

***Requested Funding:***

\$692K (FY98 New Start)

\$1,007K (FY99 Continuing Project)

***Summary:***

The objective of this project is to research, develop, and demonstrate a unique, affordable, environmentally friendly family of polymer-matrix composite (PMC) manufacturing and repair technologies for stand-alone repair of current, soon-to-be-fielded, and future Department of Defense (DoD) structures. Environmentally friendly technologies involving vacuum assisted resin transfer molding (VARTM) and various curing technologies including electron beam and ultraviolet light of composites, adhesives, recycling of fabric prepreps will be advanced. Repair concepts and technologies will be demonstrated on three DoD-specific problems, including the design and implementation of a non-autoclave repair procedure for the Army's oft-repaired helicopter rotor blades; the development, demonstration, and documentation of a repair-friendly processing method for the remanufacture of the Navy's future fielding of the Advanced Enclosed Mast Sensor System (AEMSS), and multifunctional material development for several advanced concepts for non-autoclave repair of aircraft skins for the Air Force and the Navy.

***Recommendation:***

(October) Board members raised several concerns regarding the environmental metrics that were proposed to be measured/quantified as the researchers conduct their environmental benefit analysis, as well as questioning the primary goal of the program. Acknowledging the responsiveness of the PI to many of the Board's concerns raised at the September meeting, Board members voiced concerns regarding the lack of sufficient leveraging from the services that would accelerate this seed technology and noted a lack of a clear juncture of the research effort proposed to the transfer to the military that would take it further to

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eventual field implementation. The Board moved to recommend approval of the project's request for FY98 funding with the requirement to have the PI: (1) quantify the best estimate of the environmental benefits to be accomplished for the Board to evaluate as part of the go/no-go decision; (2) identify, at the end of the first year, what portion of alternate materials utilization cost will be picked up by principal users; and (3) provide a breakout of peace-time versus wartime costs in the analysis of cost savings. The motion with requirements was approved by a vote of 7-1.

**(June)** The Board raised several concerns regarding the environmental aspects and goals of the project. Conceding the performance goals of the project, Board members questioned the true environmental benefits and accomplishments to be realized by successful completion and implementation of the composites repair research. Following further general discussion of the projects goals, the Board moved to recommend approval of the project's request for FY99 funding. A second was offered and the motion was approved by a vote of 10-0.

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***Title:***

PP-1112: Recycle and Reuse of Industrial Cleaning Rags Using Liquid Carbon Dioxide (CO<sub>2</sub>) and Surfactant Additives as a Cleaning Agent

***Performer:***

Army Armament Research, Development, and Engineering Center

***Requested Funding:***

\$439K (FY98 New Start)

***Summary:***

The technical objectives of this project are to develop, demonstrate, and evaluate liquid carbon dioxide (LCO<sub>2</sub>) fabric cleaning technology using selected surfactant additives for application to the cleaning of Department of Defense (DoD) generated industrial cleaning rags. The proposed program is divided into four phases: (1) contaminant identification, preliminary system specifications, and cleaning requirements; (2) laboratory bench-scale evaluations and feasibility studies of surfactant-enhanced LCO<sub>2</sub> rag cleaning; (3) full-scale system tests and evaluations; and (4) technology transition.

***Recommendation:***

**(October)** The Board raised several concerns regarding the cost savings issues within the scope of the project. Board members identified some unresolved cost-benefit issues comparing rag disposal costs versus the costs for proposed LCO<sub>2</sub> cleaning equipment purchasing and deployment. Citing the residual disposal problems of the surfactant-based contaminant-laden sludge, the Board expressed a difficulty in understanding the benefits of the proposed process from a strictly pollution prevention basis. With consideration of the concerns raised, as well as the rag cleaning need that the researchers intended to address, the Board moved to approve the project. The motion included the requirements for the principal investigator (PI) to: (1) provide information on potential problems/alternatives for residue management; (2) develop, within 60 days of receipt of project funds, an economic cost-benefit analysis that would include capital equipment costs and provide the results to SERDP office for evaluation; and (3) justify

overall project costs, and SERDP staff would determine any appropriate funding reductions based on the justification provided by the PI. The amended motion was approved by a vote of 7-0, with 1 abstention.

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***Title:***

PP-1113: Sol-Gel Technology for Low-Volatile Organic Compound (VOC), Nonchromated Adhesive and Sealant Applications

***Performer:***

Air Force Research Laboratory

***Requested Funding:***

\$890K (FY99 Continuing Project)

***Summary:***

The objective of this project is to develop and transition to the Department of Defense (DoD) and other organizations processes that eliminate the VOCs, chromates, and strong acids typically found in the metal surface treatment and priming steps conducted prior to the application of adhesives and/or sealants. Secondary objectives are a reduction in hazardous wastewater streams associated with current processes and improved performance compared to these processes. This project intends to build on recent work using nonchromated, zero-VOC, sol-gel technology to deposit thin organic-inorganic coatings on metal surfaces in order to develop good adhesion between the metal and subsequently applied polymers (primer, adhesive, or sealant) via covalent chemical bonding.

***Recommendation:***

(June) The Board raised questions concerning the technology transition aspect of the project. Commending the research team for the Cooperative Research and Development Agreements that were established or being pursued, Board members questioned the timing when the Services/commercial sector increase their commitment in time and money as the technology is developed. Following explanations from the Principal Investigator (PI) regarding the difficulty in obtaining funding from the Services until researchers have hard results, the Board acknowledged the situation but urged the PI to make contacts and work towards establishing the commitments of outside funding in the future. The Board moved to recommend approval for FY99 funding and the motion was seconded. Board members added a recommendation that the User's Groups have an increased role and should provide increased leveraged funds relative to SERDP funding in out years. The motion was approved by a vote of 9-0.

***Title:***

PP-1115: Green Energetics Materials

***Performer:***

U.S. Navy, Naval Surface Warfare Center

***Requested Funding:***

\$2,700K (FY98 Earmark)

***Summary:***

The project's objectives are to develop a model-based gun propellant formulation approach that integrates environmental and life-cycle cost analysis models with performance codes to identify gun propellant ingredient compositions. This approach, if used as a development/design tool, will: (1) provide up-front propellant processing environmental impact and life-cycle cost analysis; (2) optimize the final formulation and processing methods, based on environmental impact; (3) lower overall development waste by reducing trial and error during development; and (4) allow facile transition of new "green" propellant materials that offer significant waste reduction during the manufacturing and demilitarization phases.

***Recommendation:***

(June) Board members voiced concerns regarding the quality of the proposed products of a relatively short duration program that was intending to produce an expert system. The Board also inquired as to the eventual owner of the proposed system. Following further general discussion of the project's goals, the Board moved to recommend approval of the project's receipt of FY98 funding, with the requirement that any future funding for the project proceed through the normal chain of review. After the motion was seconded, Board members voiced reservations regarding Task Four of the proposed research effort, the portion of the project that focuses on model-based gun propellant formulations. The motion was approved by a vote of 7-1, with two abstentions.

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***Title:***

PP-1117: Visual Cleaning Performance Indicators for Cleaning Verification

***Performer:***

Battelle Memorial Institute

***Requested Funding:***

\$367K (FY99 New Start)

**Summary:**

This project will develop visual cleaning performance indicators (VCPI) by identifying appropriate chemical reagents that will chemically bond with various soil types to give a real-time, visual (colorimetric) indication of cleanliness. The identified reagents will then be combined with existing cleaning solutions, rinse solutions, and/or pre-dip solutions to provide improved cleaning media for evaluation of the technique. The project's technical objectives are to: (1) reduce unnecessary or excessive use of cleaning agents while ensuring adequate cleanliness levels; (2) reduce cleaning times and costs (up to 50%); (3) encourage implementation of alternative, nonhazardous cleaning products; (4) be cost-effective, reliable, and easily incorporated into existing cleaning processes; and (5) provide both qualitative and quantitative measurements, be broadly applicable to Department of Defense (DoD), Department of Energy (DOE) and industrial operations, and be applicable to a variety of surfaces and contaminant types.

**Recommendation:**

(August) The Board raised questions regarding the type of oversight within the project, specifically the expertise of the advisory panel/board (technical vs. users). Citing common Pollution Prevention issues regarding solving one problem and creating another, Board members questioned the level of effort of the researchers to investigate the potential environmental impacts of the dyes and contaminant loaded in the wastewater, as well as the capacity of the dyes to be biodegraded. Board members expressed further concerns, highlighting the concentration of the dyes to be used in this project relative to concentrations used in the manufacturing of textiles and foods, and they were assured that the concentration of the dyes would be 0.1% or less. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding the project, and the motion was approved by a vote of 6-0. This vote was later ratified in the presence of a quorum by a vote of 7-0.

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**Title:**

PP-1118: Supercritical Fluid Spray Application Process for Adhesives and Primers

**Performer:**

Johns Hopkins University

**Requested Funding:**

\$334K (FY99 New Start)

**Summary:**

The project's technical objectives are to perform: (1) fundamental research into the thermodynamics and rheology of carbon dioxide (CO<sub>2</sub>) based adhesive systems, and the modeling, adhesive phenomenology, and design of a prototype, hand-held UNICARB atomizer for their application; (2) performance testing (by Army Research Laboratory), refinement, and environmental evaluation of materials and processes for several adhesive-primer types; (3) bench-scale evaluation of adhesive material properties of given substrates per mil-spec protocols; and (4) transition to field with assistance from the Army's TACOM and Wright-Patterson Air Force Base, including environmental compliance, manufacture, and distribution of UNICARB spray process systems, and training in their use.

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**Recommendation:**

(August) Raising specific concerns regarding the go/no-go after year one, the Board questioned the Principal Investigator's (PI) confidence that this technology could be applied to adhesives. Board members voiced concerns regarding the hand-held application device relative to the two-phase nature of the polymers, and questioned whether the two phases would work in a hand-held device. Board members raised further issues regarding the eventual implementation of the technology in the field. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding for the project, and the motion was approved by a vote of 4-0-1, with one Board member abstaining. This vote was later ratified in the presence of a quorum by a vote of 7-0-1, with one Board member abstaining.

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**Title:**

PP-1119: Critical Factors for the Transition from Chromate to Chromate-Free Corrosion Protection

**Performer:**

Ohio State University

**Requested Funding:**

\$500K (FY99 New Start)

**Summary:**

The objective of this project is chromate-free corrosion protection and focuses on the film formation processes involved in producing a protective surface. There are four major phases: (1) mitigating the negative effects of microstructural heterogeneity using Ramam spectroscopy, microscopy and electrochemical tools; (2) determining the feasibility of chromate-free active corrosion protection (self-healing); (3) studying the effects of non-ideal application methods, service history and aging on structural, chemical, and performance profiles of chromate conversion coatings; and (4) developing accelerated, quantitative, and predictive diagnostic test protocols to stimulate development and implementation of chromate-free coatings.

**Recommendation:**

(August) Board members questioned the project's intention to produce a chromate-free coating process, as described in the proposal. Conceding the basic nature of the research, Board members questioned the lack of any clear fundamental research hypothesis. Citing the lack of involvement of the Navy as a project liability, Board members stressed pursuit of Navy involvement in the future, as well as making suggestions to pursue involvement with researchers from the aluminum industrial sector. Board members further suggested that SERDP provide close supervision at the annual in-progress review (IPR) to ensure an effective down-select of research options and a narrowing of research focus, as well as a critical evaluation of the project's go/no-go decision points. In the absence of a quorum, the Board moved to recommend approval of the FY99 funding for the project and included the requirements that the project come back next year and be reviewed by the SAB and that the PI make an active effort to have the Navy be a participant in the project. The motion was approved by a vote of 6-0. This vote was later ratified in the presence of a quorum by a vote of 7-0.

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***Title:***

PP-1133: Mechanisms of Military Coatings Degradation

***Performer:***

Army Research Laboratory

***Requested Funding:***

\$600K (FY99 New Start)

***Summary:***

The project's technical objective is to identify degradation mechanisms in the present-day military coatings that will facilitate future research to identify candidate replacements for current military coating systems. The focus will be to identify, model, and predict coating degradation mechanisms that frequently lead to military coating failures and force depainting/painting operations. Two important failure modes, exposure to ultraviolet radiation and moisture, will be quantified and modeled. Also, the effect of topcoat degradation on corrosion resistance and primer-substrate adhesion will be determined quantitatively and related to service life.

***Recommendation:***

(September) Board members expressed concerns that the life-cycle analysis (LCA) should be an integral part of the project. Board members commented that the PI did not have the expertise to accurately perform an LCA. The Board suggested that the lead PI of the project provide SERDP a document that expresses the expertise level of the project performers with LCA issues and address the state-of-the-art in LCA for paint systems. Questioning whether the project's focus is to produce new paint products or provide a pollution reducing process, the Board opined that SERDP's main focus is to provide projects that reduce environmental pollution within DoD and not new paint development as the project suggests. The Board moved to recommend approval of the project's FY99 funding with the requirements that: (1) the LCA be emphasized as a determinant in project evaluation; (2) the pollution prevention aspects of this endeavor be given paramount position in overall project direction; (3) the PI document in writing to SERDP the performers' expertise with the state of the art in LCA for paint systems. Once seconded, the motion was approved by a vote of 6-0.

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***Title:***

PP-1134: Development of Innovative Nondestructive Evaluation Technologies for the Inspection of Cracking and Corrosion Undercoatings

***Performer:***

Naval Surface Warfare Center

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***Requested Funding:***

\$595K (FY99 New Start)

***Summary:***

The project's technical objective is to investigate three nondestructive evaluation (NDE) techniques for the detection of corrosion, namely ultrasound imaging, thermal imaging, and near field microwave imaging. Two of the techniques, ultrasound and microwave imaging, are believed to be effective in detecting cracks under coatings and will be investigated for that purpose. In conjunction with NDE techniques development, models will be developed to correlate with the output signature of these various techniques. Electrochemical impedance spectroscopy (EIS) will be used to validate the measurements.

***Recommendation:***

(September) Board members expressed concern regarding the implementation of the proposed tool and how it would be validated for use in the field. The Board questioned whether the proposed tool be able to identify a difference in the top coating characteristics versus any true corrosion to the base metal that is found underneath, and whether there was any data that shows how many times an aircraft is stripped and what the results are for the underlying airframe. Board members expressed concern that the tool would be validated before implemented that there could be a safety issue, since the aircraft could be cleared to fly again with an undetected problem. The Board questioned the lack of peer reviewed publications within the team and that the project team needs to have an environmental performer. With consideration of the concerns voiced, the Board moved to recommend approval of the project. Discussion of the motion included a requirement that the project add an environmental performer. The motion, including this requirement, was approved by a vote of 6-0.

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***Title:***

PP-1135: Primerless Room Temperature Vulcanizing (RTV) Silicone Sealants/Adhesives

***Performer:***

U.S. Army Tank-Automotive & Armaments Command (TACOM) - Armaments Research, Development & Engineering Center (ARDEC)

***Requested Funding:***

\$731K (FY99 New Start)

***Summary:***

The project's technical objectives are to develop and transition to Department of Defense (DoD) and other organizations a primerless, self-bonding, low-temperature-curable (<65°F), addition-cured silicone adhesive and sealant technology which will eliminate the use of high volatile organic compound (VOC) solvent-borne primers without compromising durability, compatibility, thermal resistance, and long-term stability. The new silicones will meet or exceed stringent DoD and Department of Energy (DOE)

requirements. A secondary objective is the simplification of the application methodology for silicone adhesives and sealants.

***Recommendation:***

(September) Board members questioned if the VOC problem is severe within DoD, and if not, why is SERDP addressing a small problem. A Board member inquired if the project, if successful, would eliminate the VOC release problem at certain DoD bases, or are the sealants just part of the overall problem. A Board member expressed concern that the new silicone sealants could become a carcinogen to the labor force and that the project needs to test the toxicity and carcinogenicity of the sealants to prevent health hazards. The Board moved to recommend approval the project for FY99 funding. The motion, with the requirement that the project investigate the toxicity (including carcinogenicity) of the selected alternatives be evaluated, was approved by a vote of 6-0.

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***Title:***

PP-1137: Nondestructive Testing of Corrosion Undercoatings

***Performer:***

Northrop Grumman Corporation

***Requested Funding:***

\$268K (FY99 New Start)

***Summary:***

The project's technical objectives are to develop: (1) a spectral nondestructive evaluation (NDE) technique employing an optical reflectance probe in the near/mid infrared region combined with directional hemispherical reflectance (DHR) and Fourier Transform Infrared (FTIR) integrated detector; (2) wide-area spectral imaging (WASI) using spectral filters and high-resolution focal plane cameras to allow rapid initial assessment of sub-paint corrosion; and (3) a scanning kelvin probe (SKP) electrochemical method employing a calibrated capacitance probe to indirectly measure corrosion potential across a surface.

***Recommendation:***

(September) Board members were concerned that the project had not coordinated with private industry regarding the state-of-the-art for the proposed technology. Board members opined that it is possible the technology is currently being used in commercial industry and the Board expressed the need to find out if the technology is truly state-of-the-art to prevent overlap between the military and the private sector paint and repair methodologies. Board members suggested that the project should include other private industry experts to address the Board's concern whether the technology is state-of-the-art, and to ensure that no overlap occurs between the military and private sector technologies. Board members advised the PI that the project needs to keep an environmental focus throughout the program. The Board moved to recommend approval the project's request for FY99 funding. The motion was approved by a vote of 6-0. The Board emphasized the requirement that the project coordinate with industry and requested that SERDP and the PI formally address the SAB's concerns regarding the state-of-the-art status of this technology.

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**Title:**

PP-1138: Cleaning Verification Technique Based on Infrared Optical Methods

**Performer:**

Sandia National Laboratory

**Requested Funding:**

\$497K (FY99 New Start)

**Summary:**

The project's technical objectives are to develop two prototype instruments with complementary capabilities for cleaning verification. In each case, surface contamination will be detected via its alteration of the grazing-incidence infrared reflectance of the surface. Specifically, the project will: 1) develop a prototype on-line widely tunable infrared laser-based instrument with high speed surface-imaging capability but with limitations on the number of detectable organic contaminants; and 2) optimize an FTIR-based instrument with high sensitivity for organic species on a variety of surfaces, but with limitations on speed and surface coverage for real-time analysis of surface contaminants at very low-level concentrations. The proposed instruments will differ in the nature of the information they provide. The first will produce images that directly indicate the spatial extent and location of contamination. The second will provide a spectrally resolved measurement of the surface reflectance at a single point.

**Recommendation:**

(September) The Board stated that the project had an added benefit that reduction of unnecessary quantities of solvents to effectively clean aircraft is a major environmental goal of the Department of Defense, and this project would help to address this problem. Board members were impressed with the technology transition plan of the project and inquired if the proposed technology would provide any benefits for the Department of Energy's environmental problems. The Board moved to recommend approval the project's request for FY99 funding. The motion was approved by a vote of 6-0.

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**Title:**

PP-1139: Non-Structural Adhesives Requiring No Volatile Organic Compounds (VOCs)

**Performer:**

Montana Biotech Corporation

**Requested Funding:**

\$241K (FY99 New Start)

**Summary:**

The project's technical objectives are to develop innovative, compliant, adhesive polymers that have no requirement for VOCs. The source of these polymers will be microorganisms isolated from high-temperature waters. Extracellular polymers produced by novel microorganisms called extremophiles isolated from natural hot springs will be examined for non-structural adhesive properties. A two-phased approach will be applied toward the analysis and development of these novel polymer adhesives: (1) screening new polymers using standard physical performance tests of adhesive properties; and (2) detailed analysis that will lead to the formation of derivative compounds with expanded capabilities.

**Recommendation:**

(September) Board members questioned if any evidence suggests that Archae bacteria (Extremophiles) could provide better structural properties than other microorganisms and would these adhesives be able to tolerate the extreme environments that are commonly found in the field. Board members noted that the project was a very novel and exciting idea, but were concerned that the adhesives may not be strong enough to withstand current Department of Defense (DoD) applications and therefore may have limited benefit to DoD. Board members suggested that SERDP should determine the appropriate level of effort for the first year and assess at which point the research and screening of the microorganisms should stop. Board members questioned if the proposed microbial adhesives are toxic and if there is planned testing to determine the toxicity and carcinogenicity. Regarding the testing of the adhesive properties, the Board questioned if there was a standard metric that will be used to quantify properties of the adhesives produced. The Board moved to recommend approval the project for FY99 funding. The motion, with the requirements that the metrics for the go/no-go decision ("significant adhesive properties") need to be defined prior to conducting the evaluation, and the project is to brief the Board again next year, was approved by a vote of 5-1. One Board member cast the negative vote stating that this project is a conceptual idea with limited benefit.